VOLUME I, BOOK 2

APPENDIX D FINAL REPORT

ENERGY SAVINGS OPPORTUNITY SURVEY (ESOS)

WHITE SANDS MISSILE RANGE NEW MEXICO

Prepared for

DEPARTMENT OF THE ARMY FORT WORTH DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

Under

CONTRACT NO. DACA63-91-C-0152 EMC No. 1110-000

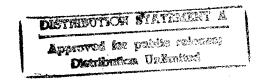
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November 1992

By

E M C ENGINEERS, INC. 2750 South Wadsworth Blvd. Suite C-200 Denver, Colorado 80227

This study consists of VOLUME I BOOK 1, VOLUME I BOOK 2, AND VOLUME II



APPENDIX D

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DEPARTMENT OF THE ARMY

CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS P.O. BOX 9005 CHAMPAIGN, ILLINOIS 61826-9005

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Marie Wakeffeld, Librarian Engineering

VOLUME I, BOOK 2 APPENDIX D

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LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION: Whi	ta Sanda Missil	o Pongo	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		LOCATION: Whi		e Hange DG. T117 – ROOF INSUL		4	FISCAL YEAR:	1992
					LATION		FISCAL TEAR.	1992
		DISCRETE PORTI		TOTAL	FOONOMO LIFE.	05	DDEDADED BY	A STOVED
		ANALYSIS DATE:	06/09/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IN	VESTMENT						
	A.	CONSTRUCTION	COST	=	0		\$1,450	
	В.	SIOH COST		(5.5% of 1A) =			\$80	
	C.	DESIGN COST		(6.0% of 1A) =			\$87	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$1,617	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	ENT	(1D - 1E) =			>	\$1,617
		IEDOV OANUNGO (\					
Z	CIN	IERGY SAVINGS (+) FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
		FUEL TIPE	\$/MBTU (1)		SAVINGS (3)	DISCOUNT FACTOR (4)		
		ELEC	\$/MB10(1) \$18.37	MBTU/YR (2)	5 SAVINGS (3) \$9	15.23	• •	
		DIST	ψ10.3 <i>1</i>	0.	پ \$0	17.28	_	
	-	NAT GAS	\$2.21	45		19.64	·	
		PAPER	Ψ2.21	49	\$100	15.04	\$1,500	
		COAL		·	\$0	16.22	•	
		TOTAL		46	108.6		 >	\$2,095
	٠.	TOTAL		40	100.0			\$2,055
3	NC	ON-ENERGY SAVIN	IGS (A) / COST	(-)				
Ŭ				C. DEMAND SAVINGS)			\$0	
	Α,	1 DISCOUNT FAC		o. DEMAND ON THEO,	(From Table A-2) =	14.68	•	
		2 DISCOUNTED		COST (-)	(3A x 3A1) =	14.50	\$0	
	8.	NON-RECURRIN		.00.()	(O/IX G/(I) =		43	
	-	ITEM	-()		YEAR OF	DISCOUNT	DISCOUNTED	
		, . <u>_</u>		SAVINGS (1)				
		a.		\$0	(2)	0.00	` ,	
		b.		\$0		0.00	•	
		с.		\$0		0.00	•	
		d TOTAL		\$0		0.00	\$0	
	C.		RGY DISCOUN	NTED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =	40	\$0
		PROJECT NON-E			()	(3.2 : 324),		44
		1 25% MAXIMUM		Y CALCULATION		(2F5 x 0.33) =	\$691	
		a IF 3D1 => 3C				(=, 0 , 0,000)	4 00.	
		b IF 3D1 < 3C T				(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1			•	(
		d IF 3D1b < 1 T	HEN PROJECT	DOES NOT QUALIFY				•
A	FII	RST YEAR DOLLAR	RAVINGELLY	COSTS (_)	(050	+ 2A + /2P14/0E\\ =		\$ 100
		OTAL NET DISCOU			(253	= (2F5 + 3C) = (2F5 + 3C)		\$109 \$2.095
						,		\$2,095
9				TMENT RATIO (SIR)		(5/1F) =		1.30
-		IF SIR < 1 THEN PR		NOT QUALIFT)		/4 = /^		
- /	311	MPLE PAYBACK (S	ro)			(1F/4) =		14.88

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NWC							
CONTRACTOR	EMC ENGINEERS INC			ADDRESS 9750 CO	WOON UTI	N IO DEGO	000 0#		10000	
CONTRACT	CONTRACT FOR (Work to be performed) ROOF INSTIT ATION - BLDG 117			200	PROPOSED TOTAL CONTRACT PRICE	100	PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE	0 00221	
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER.		WORK LOCATION	E MISSILE	WORKLOCATION WHITE CANDO MICCH E DANGE NEW MEXICO	OO!XHA
				MATERIAL COST	Loost		LABOR COSTS	IDS MISSIEL	י האואטב, ואב	W MEAICO
Line	ltem	Crit of	Quantity				Average		Other Direct	Line
N	(1)	Measure (2)	(3)	Unit (4)	Total (5)	Mandays (6)	Rate	Total (8)	Costs (9)	Total (10)
	INSTALL ROOF INSULATION									
	R19 FIBERGLASS BATT INSULATION	SF	2525	0.49	1232.2	0.01	17.24	217.65		\$1,449.86
	Labor Source: U.S. Dept of Labor, General Wage Decision No. NM91-1	cision No. NA	A91-1							
	Material costs from Means Building									
	Construction Cost Data, 1992			,						
	Unit prices include overhead & profit of 25%									
	TOTAL THIS SHEET									\$1,449.86
				1						

ESOS STUDY AT WSMR
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
BLDG. 117 ROOF INSUL CALTI-BSLM ALTZ-ECO

Weather File Code:	ELPASO.W
Location:	
Latitude:	31.0 (deg)
Longitude:	106.0 (deg)
Time Zone:	6

Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)

Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	

0.0653	(Lbm/cuft)
0.2444	(Btu/lbm/F)
0.9575	(Btu-min./hr/cuft/F)
4,214.8	(Btu-min./hr/cuft)
3.9171	(Lb-min./hr/cuft)
	0.2444 0.9575 4,214.8

Design Simulation Period:	June 1	o November
System Simulation Period:	January 1	o December
Cooling Load Methodology:	TETD/T	ime Averaging

Time/Date Program was Run:	16: 5:37	12/20/91
Natacet Name:	117	TH

AIRFLOW - ALTERNATIVE 1 BASELINE - BUILDING 117

(Design Airflow Quantities)

		******		Main			Auxil.	Room
System Number	System Type	Outside Airflow (Cfm)	Cooling Airflow (Cfm)	Heating Airflow (Cfm)	Return Airflow (Cfm)	Exhaust Airflow (Cfm)	Supply Airflow (Cfm)	Exhaust Airflow (Cfm)
1 9	sz	0	0	1,987	2,484	497	0	0
Totals		0	0	1,987	2,484	497	0	0

CAPACITY - ALTERNATIVE 1 BASELINE - BUILDING 117

(Design Capacity Quantities)

------ Cooling ------- Heating ------Reheat Humidif. Opt. Vent Main Sys. Aux. Sys. Opt. Vent Cooling Main Sys. Aux. Sys. Preheat Heating System System Capacity Capacity Capacity Totals Capacity Capacity Capacity Capacity Capacity Totals Type (Tons) (Tons) (Tons) (Tons) (Btuh) (Btuh) (Btuh) (Btuh) (Btuh) (Btuh) (Btuh) 1 SZ 0.0 0.0 0.0 0.0 -100,000 0 -100,000 Totals 0.0 0.0 0.0 0.0 -100,000 0 0 -100,000

The building peaked at hour 16 month 6 with a capacity of

0.0 tons

ENGINEERING CHECKS - ALTERNATIVE 1

BASELINE - BUILDING 117

occidentials

------ ENGINEERING CHECKS-----

			Percent		Cool	ing		Heat	ing	
System	Main/	System	Outside	Cfm/	Cfm/	Sq Ft	Btuh/	Cfm/	Btuh/	Floor Area
Number	Auxiliary	Туре	Air	Sq Ft	Ton	/Ton	Sq Ft	Sq Ft	Sq Ft	Sq Ft
1	Main	SZ .	0.00	0.00	0.0	0.0	0.00	1.00	-50.32	1,987

D1-4

timenouseus

System 1 Peak SZ - SINGLE ZONE

Peaked a	t Time ==	>	Mo/Hr:	0/0			*	Mo	/Hr:	0/0 4	,	Mo/Hr:	13/ 1	
Outside			B/WB/HR:	0/ 0/ 0.	0		*		ADB:	0 1	,	OADB:	-	
			-••				*			•	,	ONDD:		
		Space	Ret. Air	Ret. Air	Net	Percnt	*	s	pace	Percnt 1	Space P	eak Coi	l Peak	Percni
	s	ens.+Lat.	Sensible	Latent	Total	Of Tot	*	Sens	ible	Of Tot	Space S		t Sens	Of Tot
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(B	tuh)	(%) *	(Bt	uh)	(Btuh)	(%)
Skylit	e Solr	0	0		0	0.00	*		0	0.00	•	0	0	0.00
Skylit	e Cond	0	0		0	0.00	*		0	0.00	•	0	0	0.00
Roof C	ond	0	0		0	0.00	*		0	0.00	-24,	484 -:	24,484	26.25
Glass	Solar	0	0		0	0.00	*		0	0.00	•	0	0	0.00
Glass	Cond	0	0		0	0.00	*		0	0.00	-17,	729 -	17,729	19.01
Wall C	ond	0	0		0	0.00	*		0	0.00 *	-24,	916 -	24,916	26.71
Partit	ion	0			0	0.00	*		0	0.00 *	•	0	0	0.00
Expose	d Floor	0			0	0.00	*		0	0.00	-5,	214	-5,214	5.59
Infilt	ration	0			0	0.00	*		o	0.00	-		20,931	22.44
Sub To	tal==>	0	0		0	0.00	*		0	0.00	-93,		93,274	100.00
Internal	Loads						*			*				
Lights		0	0		0	0.00	*		0	0.00 *		0	0	0.00
People		0			0	0.00	*		0	0.00 *		0	0	0.00
Misc		0	0	0	0	0.00	*		0	0.00 *		0	0	0.00
Sub To	tal==>	0	0	0	0	0.00	*		0	0.00 *		0	0	0.00
Ceiling	Load	0	0		0	0.00	*		0	0.00 *		0	0	0.00
Outside .	Air	0	0	0	0	0.00	*		0	0.00 *		0	0	0.00
Sup. Fan	Heat				0	0.00	*			0.00 *			0	0.00
Ret. Fan	Heat		0		0	0.00	*			0.00 *			0	0.00
Duct Hea	t Pkup		0		0	0.00	*			0.00 *			0	0.00
OV/UNDR	Sizing	0			0	0.00	*		0	0.00 *		0	0	0.00
Exhaust	Heat		0	0	0	0.00	*			0.00 *		-	0	0.00
Terminal	Bypass		0	0	0	0.00	*			0.00 *			0	0.00
							*			*			•	
Grand To	tal==>	0	0	0	0	0.00	*		0	0.00 *	-93,	274 -9	93,274	100.00
			coot	ING COIL S	ELECTION			*****				AREAS	s	
	Total (Capacity	Sens Cap.	Coil Airfl	Enteri	ng DB/WB	/HR	Lea	ving DI	B/WB/HR	Gross To	tal GI	lass (sf	f) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	g F Gra	ins	Deg F	Deg F	Grains	Floor	1,987		
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Part	0		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	1,987		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	1,987		0 0
otals	0.0	0.0									Wall	2,300	3	320 14
	HEATING	G COIL SELE	CTION		AII	RFLOWS (cfm)-		6	NGINEERING	CHECKS	TEMPE	ERATURES	S (F)
	Capacity	/ Coil Ai	rfl Ent	Lvg	Туре	Cooling	ŀ	leating		% OA	0.0	Туре		
	(Mbh)	(cfm) Deg F	Deg F	Vent	0		0	Cle	Cfm/Sqft	0.00	SADB	0.0	-
lain Htg	-100.0	1,9	87 64.5	117.0	Infil	0		497	Cle	Cfm/Ton	0.00	Plenum	0.0	
lux Htg	0.0)	0.0	0.0	Supply	0		1,987	Cle	Sqft/Ton	0.00	Return		
reheat	-0.0	1,9	87 68.0	0.0	Mincfm	0		0		Btuh/Sqft		Ret/OA	0.0	
leheat	0.0)	0.0	0.0	Return	0		1,987		People	0	Runarno		
lumidif	0.0)	0.0	0.0	Exhaust	0		0		% OA	0.0	Fn MtrT		
pt Vent	0.0	1	0.0	0.0	Rm Exh	•		•	-					
pr vent	0.0	<i>-</i>	• • • • • • • • • • • • • • • • • • • •	0.0	KIII EAII	0		0	HTG	Cfm/SqFt	1.00	Fn BldT	rd 0.0	0.1

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1

BASELINE - BUILDING 117

------ AIRFLOW HEATING LOADS------(At time of Coil Peak)

			Vent	ilation	Op.	Vent	Rel	heat	Hum	idif	
Room			Airflow	Sensible	Airflow	Sensible	Airflow	Sensible	Airflow	Latent	Total
Number		Description	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Btuh)
1	BLDG	117	0	0	0	0	0	0	0	0	0
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1	Block	0	0	0	0	0	0	0	0	0
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0
System	1	Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1 BASELINE - BUILDING 117

------AIRFLOW HEAT GAIN AND LOSS------(At time of Coil Peak)

							- neating	9					
			Supply	Return	System		System	Room			Run		System
			Fan	Fan	Exhaust		Exhaust	Exhaust	Ducted	Plenum	Around	Corridr	Return
Room			Heat	Heat	Heat Loss	Total	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow
Number	ı	Description	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)
1	BLDG	117	0	0	0	0	0	0	0	0	0	0	1,987
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	1,987
Zone	1	Block	0	0	0	0	0	0	0	0	0	0	1,987
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	1,987
System	1	Block	0	0	0	٥	0	0	0	0	0	0	1,987

BUILDING U-VALUES - ALTERNATIVE 1 BASELINE - BUILDING 117

------ BUILDING U-VALUES------

						Roo (Btu	m U-Val ı/hr/sqf					Room Mass	Room Capac.
Room					Summe	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Desc	cription	Part.	Exflr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	BLDG	117	0.000	0.328	0.000	0.000	0.280	1.140	1.259	0.286	0.000	30.4	10.68
Zone	1.1	Total/Ave.	0.000	0.328	0.000	0.000	0.280	1.140	1.259	0.286	0.000	30.4	10.68
System	1	Total/Ave.	0.000	0.328	0.000	0.000	0.280	1.140	1.259	0.286	0.000	30.4	10.68
Buildin	g		0.000	0.328	0.000	0.000	0.280	1.140	1.259	0.286	0.000	30.4	10.68

BUILDING AREAS - ALTERNATIVE 1
BASELINE - BUILDING 117

Room Number	Description	er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	/Rf	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1 Zone System Building	BLDG 117 1 Total/Ave. 1 Total/Ave.	1	1,987	1,987 1,987 1,987 1,987	0 0 0	1,987 1,987 1,987 1,987	0 0 0	0 0 0	1,987 1,987 1,987 1,987	320 320 320 320	14 14 14 14	1,980 1,980 1,980 1,980

ASHRAE 90 ANALYSIS - ALTERNATIVE 1
BASELINE - BUILDING 117

----- A S H R A E 90 A N A L Y S I S -----

Overall Roof U-Value = 0.280 (Btu/Hr/Sq Ft/F)
Overall Wall U-Value = 0.405 (Btu/Hr/Sq Ft/F)
Overall Building U-Value = 0.347 (Btu/Hr/Sq Ft/F)

Roof Overall Thermal Transfer Value (OTTVr) = 21.81 (Btu/Hr/Sq Ft)
Wall Overall Thermal Transfer Value (OTTVw) = 25.04 (Btu/Hr/Sq Ft)

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1
BASELINE - BUILDING 117

System Totals

Percent	Cool	ing Loa	ad	Heatir	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Kours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-5,000	5	153	99.4	0	0	0.0	0	0
5 - 10	0.0	0	0	-10,000	6	181	198.7	0	0	0.0	0	0
10 - 15	0.0	0	0	-15,000	5	149	298.1	0	0	0.0	0	0
15 - 20	0.0	0	0	-20,000	8	220	397.5 `	0	0	0.0	0	Õ
20 - 25	0.0	0	0	-25,000	- 11	313	496.8	0	0	0.0	0	0
25 - 30	0.0	0	0	-30,000	8	237	596.2	0	0	0.0	0	0
30 - 35	0.0	0	0	-35,000	8	231	695.6	0	0	0.0	0	0
35 - 40	0.0	0	0	-40,000	11	318	794.9	0	0	0.0	0	0
40 - 45	0.0	0	0	-45,000	11	309	894.3	0	0	0.0	0	0
45 - 50	0.0	0	0	-50,000	6	180	993.7	0	0	0.0	0	0
50 - 55	0.0	0	0	-55,000	8	214	1,093.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-60,000	3	96	1,192.4	0	0	0.0	0	0
60 - 65	0.0	0	0	-65,000	6	180	1,291.7	0	0	0.0	0	0
65 - 70	0.0	0	0	-70,000	0	10	1,391.1	0	0	0.0	0	0
70 - 75	0.0	0	0	-75,000	0	0	1,490.5	0	0	0.0	0	0
75 - 80	0.0	0	0	-80,000	0	0	1,589.8	0	0	0.0	0	0
80 - 85	0.0	0	0	-85,000	0	0	1,689.2	0	0	0.0	0	0
85 - 90	0.0	0	0	-90,000	0	0	1,788.6	0	0	0.0	0	0
90 - 95	0.0	0	0	-95,000	0	0	1,887.9	0	0	0.0	0	0
95 - 100	0.0	0	0	-100,000	0	0	1,987.3	100	7,356	0.0	0	0
Hours Off	0.0	0	8,760	0	0	5,969	0.0	0	1,404	0.0	0	8,760

annomina i

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------ MONTHLY ENERGY CONSUMPTION -----

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	1,035	4	315	1
Feb	893	4	241	1
March	937	4	123	1
April	772	4	30	0
May	786	4	0	0
June	781	4	0	0
July	728	4	0	0
Aug	815	4	0	0
Sept	723	4	0	0
Oct	854	4	41	0
Nov	858	4	142	1
Dec	993	4	245	1
Total	10,175	4	1,136	1

Building Energy Consumption =
Source Energy Consumption =

74,663 (Btu/Sq Ft/Year) 76,431 (Btu/Sq Ft/Year) Floor Area =

1,987 (Sq Ft)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

----- EQUIPMENT ENERGY CONSUMPTION ------

Ref	Equip -						hly Cons		••••••			•••••		
Num	Code	Jan	Feb	Mar	Арг	May	June	July	Aug	Sep	0ct	Nov	Dec	Total
0	LIGHTS													
	ELEC	757	685	815	723	786	781	728	815	723	786	723	728	9,053
	PK	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
1	MISC LD													-
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	MISC LD													
	GAS	0	0	0	0	0	0	0	0	0	0	0	0	C
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	MISC LD													
	OIL	0	0	0	0	0	0	0	0	0	0	0	0	C
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	MISC LD													
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	MISC LD													
	P HOTH20	0	0	0	0	0	0	0	0	0	0	0	0	C
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	MISC LD													
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	EQ2454		RESIC	ENT GAS	FURNACE	W-FAN								
	GAS	315	241	123	30	0	0	0	0	0	41	142	245	1,136
	PK	1.0	0.9	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.4	0.6	0.8	1.0
1	EQ5254		RESIC	ENTIAL F	URNACE I	FAN								
	ELEC	278	208	122	48	0	0	0	0	0	68	134	265	1,123
	PK	0.4	0.4	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4

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UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

		•
UTILITY P	EAK CHECKSUMS	
Utility ELECTRIC DEMAND		
Peak Value 4.3 (kW)		
Yearly Time of Peak 9 (hr) 1 (mo)	•	
Hour 9 Month 1	•	
Sub Total	0.0 0.00	
Heating Equipment	•	
1 EQ2454 RESIDENT GAS FURNACE W-FAN	0.4 8.58	
Sub Total	0.4 8.58	
Sub Total	0.0 0.00	
Sub Total	0.0 0.00	
Miscellaneous		
Lights	4.0 91.42	
Base Utilities	0.0 0.00	
Misc Equipment	0.0 0.00	
Sub Total	4.0 91.42	

4.3 100.00

Grand Total

ESOS STUDY AT WSMR
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.

BLDG. 117 ROOF INSUL.:ALT1-BSLN, ALT2-ECO ECO#1

Weather File Code: ELPASO.W
Location:
Latitude: 31.0 (deg)
Longitude: 106.0 (deg)
Time Zone: 6
Elevation: 3,918 (ft)
Barometric Pressure: 25.8 (in. Hg)

Summer Clearness Number: 1.00
Winter Clearness Number: 1.00
Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: June To November
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 16: 5:37 12/20/91
Dataset Name: 117 .TM

D1-13

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AIRFLOW - ALTERNATIVE 2
ECO ROOF INSULATION - BUILDING 117

(Design Airflow Quantities)

0		Outside	Cooling	Heating	Return	Exhaust	Auxil. Supply	Room Exhaust
System Number	System Type	Airflow (Cfm)						
1 5	sz	0	0	1,987	2,484	497	0	0
Totals		0	0	1,987	2,484	497	0	0

CAPACITY - ALTERNATIVE 2
ECO ROOF INSULATION - BUILDING 117

CDesign Capacity Quantities)

------ Cooling ------- Heating ------Main Sys. Aux. Sys. Opt. Vent Cooling Main Sys. Aux. Sys. Preheat Reheat Humidif. Opt. Vent System System Capacity Capacity Capacity Capacity Capacity Capacity Capacity Capacity Capacity Totals (Tons) (Tons) Type (Tons) (Tons) (Btuh) (Btuh) (Btuh) (Btuh) (Btuh) (Btuh) 1 SZ 0.0 0.0 0.0 0.0 -100,000 0 0 0 0 -100,000 Totals 0.0 0.0 0.0 0.0 -100,000 0 0 0 0 -100,000

The building peaked at hour 16 month 7 with a capacity of 0.0 tons

ENGINEERING CHECKS - ALTERNATIVE 2 ECO ROOF INSULATION - BUILDING 117

------ ENGINEERING CHECKS-----

		,	Percent		Cool	ing		Heat	ing	
System Number	Main/ Auxiliary	System Type	Outside Air	Cfm/ Sq Ft	Cfm/ Ton	Sq Ft /Ton	Btuh/ Sq Ft	Cfm/ Sq Ft	Btuh/ Sq Ft	Floor Area Sq Ft
1	Māin	sz	0.00	0.00	0.0	0.0	0.00	1.00	-50.32	1,987

System	
--------	--

1 Peak SZ

- SINGLE ZONE

*****	*****	****** C	OOLING COIL	. PEAK ****	*****	*****	*****	**** CLG	SPACE	PEAK ****	******	EATING CO	IL PEAK *	*****
	t Time ==:		Mo/Hr:				*			0/ 0	*		: 13/ 1	
Outside /	Air ==>	OAI	OB/WB/HR:	0/ 0/ 0	.0		*	c	DADB:	0	*		: 24	
							*				*			
		Space	Ret. Air	Ret. Air	Ne	t Perci	nt *	S	Space	Percnt	* Space	Peak Co	il Peak	Percnt
	Se	ens.+Lat.	Sensible	Latent	Tota				ible	Of Tot	=		ot Sens	Of Tot
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh) (t	() ±	(8	Stuh)	(%)	-	tuh)	(Btuh)	(%)
Skylite	e Solr	0	C) '		0 0.0	00 *		0	0.00	*	0	0	0.00
Skylite	e Cond	0	C)		0 0.0	00 *		0	0.00	*	0	0	0.00
Roof Co	ond	0	C)			00 *		0	0.00	* -3	,847	-3,847	5.30
Glass S	Solar	0	C)		0 0.0	00 *		0	0.00		0	0	0.00
Glass (Cond	0	C	1		0 0.0	00 *		0	0.00	* -17	,729	-17,729	24.41
Wall Co	ond	0	C)			00 *		0	0.00			-24,916	34.30
Partiti	ion	0					00 *		0	0.00		0	0	0.00
Exposed	d Floor	0					00 *		0	0.00		,214	-5,214	7.18
Infilt		0					00 *		0	0.00		•	-20,931	28.82
Sub Tot		0	0	t		0 0.0			0	0.00			-72,638	100.00
Internal		•	•	•		• •.•	*		·		*	,030	-12,030	100.00
Lights	•	.0	0	1		0 0.0	າດ *		0		*	0	0	0.00
People		0	•	•			0 *		0	0.00		0	0	0.00
Misc		0	0	0			00 *		0	0.00		0	0	
Sub Tot	tal ==>	0	0				10 *		0	0.00		0	0	0.00
Ceiling L		0	0	-			0 *		0	0.00		0	-	0.00
Outside /		0	0				0 *		0	0.00		0	0	0.00
Sup. Fan		v	•				0 *		o		•	U	0	0.00
Ret. Fan			0	1						0.00	- •		0	0.00
Duct Heat			0				0 *			0.00	_		0	0.00
OV/UNDR S	•	0	U	ı			0 *		•	0.00	•	•	0	0.00
Exhaust H	-	•	0	0			0 *		0		- *	0	0	0.00
Terminal			0	-			0 *						0	0.00
i ei mii iat	oypass		U	U	'	0 0.0	0 *			0.00	- b		0	0.00
Grand Tot	:al==>	0	0	0	1	0.0	0 *		0	0.00		,638	-72,638	100.00
•••••			coo	LING COIL S	ELECTION							ARE	AS	
	Total C			Coil Airfl		ing DB/W				B/WB/HR	Gross To	otal	Glass (sf) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F D	eg F Gr	ains	Deg F	Deg F	Grains	Floor	1,987		
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Part	. 0		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	1,987		
Opt Vent	0.0	. 0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	1,987		0 0
Totals	0.0	0.0									Wall	2,300	32	20 14
	HEATING	COIL SELE	CTION		А	IRFLOWS	(cfm)		1	ENGINEERING	CHECKS	TEM	PERATURES	(F)
	Capacity	Coil Ai	rfl Ent	Lvg	Type	Coolin	g	Heating	Cle	g % OA	0.0	Туре	e Clg	Htg
	(Mbh)	(cfm) Deg F	Deg F	Vent		0	0	Cl	g Cfm/Sqft	0.00	SADB	0.0	106.2
Main Htg	-100.0	1,9	87 53.6	106.2	Infil		0	497	Cle	g Cfm/Ton	0.00	Plenur	n 0.0	68.0
Aux Htg	0.0		0.0	0.0	Supply		0	1,987	Cle	g Sqft/Ton	0.00	Return	0.0	68.0
Preheat	-0.0	1,9	87 68.0	0.0	Mincfm		0	0	Cts	g Btuh/Sqft	0.00	Ret/O		68.0
Reheat	0.0		0.0	0.0	Return		0	1,987	No.	People	0	Runarr		68.0
Humidif	0.0		0.0	0.0	Exhaust	-	0	0	Htg	3 % OA	0.0	Fn Mtr	0.0	0.1
Humidif Opt Vent	0.0		0 0.0	0.0	Exhaust Rm Exh		0	0 0		g % OA g Cfm/SqFt	0.0 1.00	Fn Mtr Fn Blo	•	0.1

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HEATING LOADS AT COIL PEAK - ALTERNATIVE 2 ECO ROOF INSULATION - BUILDING 117

--- Ventilation -- --- Op. Vent.---- Reheat ----- Humidif. ----Room Airflow Sensible Airflow Sensible Airflow Sensible Airflow Latent Number (Btuh) (Cfm) (Btuh) (Cfm) (Btuh) (Cfm) (Btuh) Description (Cfm) (Btuh) 1 BLDG 117 0 0 0 0 0 0 Ω 0 0 1 Total/Ave. 0 0 0 0 0 Ω 0 0 0 1 Block Zone 0 0 0 0 0 0 0 O Ω 1 Total/Ave. 0 System 0 0 0 0 0 0 0 System 1 Block 0 0 O

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2 ECO ROOF INSULATION - BUILDING 117

AIRFLOW HEAT GAIN AND LOSS------(At time of Coil Peak)

------ Heating ------Return Supply System System Room Run System Fan Fan Exhaust Exhaust Exhaust Ducted Plenum Around Corridr Return Total Airflow Airflow Airflow Airflow Airflow Airflow Airflow Room Keat Heat Heat Loss Number Description (Btuh) (Btuh) (Btuh) (Cfm) (Cfm) (Cfm) (Cfm) (Cfm) (Cfm) (Cfm) 1 BLDG 117 0 Ω O 0 0 0 1,987 1 Total/Ave. Zone 0 0 0 0 0 0 0 0 0 1,987 1 Block 0 Zone 0 0 0 0 0 0 0 1,987 0 0 1 Total/Ave. System 0 0 0 0 0 0 Ω 0 1,987 0 0 System 1 Block 0 0 0 0 Ω 0 0 1,987

BUILDING U-VALUES - ALTERNATIVE 2 ECO ROOF INSULATION - BUILDING 117

------BUILDING U-VALUES------

----- Room U-Values -----Room Room (Btu/hr/sqft/F) Mass Capac. Room Summer Winter Summer Winter (lb/ Number Description Part. ExFlr Skylt Skylt Roof Windo Windo Wall Ceil. sqft) sqft/F) 1 BLDG 117 0.000 0.328 0.000 0.000 0.044 1.140 1.259 0.286 0.000 30.4 10.68 Zone 1 Total/Ave. 0.000 0.328 0.000 0.000 0.044 1.140 1.259 0.286 0.000 30.4 10.68 System 1 Total/Ave. 0.000 0.328 0.000 0.000 0.044 1.140 1.259 0.286 0.000 30.4 10.68 Building 0.000 0.328 0.000 0.000 0.044 1.140 1.259 0.286 0.000 30.4 10.68

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BUILDING AREAS - ALTERNATIVE 2 ECO ROOF INSULATION - BUILDING 117

Room				er of icate	Floor Area/Dupl Room	Total Floor Area	Partition Area	Exposed Floor Area	Skylight Area	Skl /Rf	Net Roof Area	Window Area	Win /Wl	Net Wall Area
Number	Descr	iption	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	BLDG	117	1	1	1,987	1,987	0	1,987	0	0	1,987	320	14	1,980
Zone	1	Total/Ave.				1,987	0	1,987	0	0	1,987	320	14	1,980
System	1	Total/Ave.				1,987	0	1,987	0	0	1,987	320	14	1,980
Buildin	g					1,987	0	1,987	0	0	1,987	320	14	1,980

ASHRAE 90 ANALYSIS - ALTERNATIVE 2 ECO ROOF INSULATION - BUILDING 117

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----- ASHRAE 90 ANALYSIS-----

Overall Roof U-Value = 0.044 (Btu/Hr/Sq Ft/F) Overall Wall U-Value

= 0.405 (Btu/Hr/Sq Ft/F)

Overall Building U-Value = 0.238 (Btu/Hr/Sq Ft/F)

Roof Overall Thermal Transfer Value (OTTVr) = 2.26 (Btu/Hr/Sq Ft) Wall Overall Thermal Transfer Value (OTTVW) = 25.04 (Btu/Hr/Sq Ft)

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SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2 ECO ROOF INSULATION - BUILDING 117

System Totals

Percent	Cool	ing Loa	ad	Heati	ng Load		Cooling	Airflow		Heating	Airflo	,
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-5,000	9	214	99.4	0	0	0.0	0	0
5 - 10	0.0	0	0	-10,000	8	181	198.7	0	0	0.0	0	0
10 - 15	0.0	0	0	-15,000	9	202	298.1	0	0	0.0	0	0
15 - 20	0.0	0	0	-20,000	11	266	397.5	0	0	0.0	0	0
20 - 25	0.0	0	0	-25,000	12	280	496.8	0	0	0.0	0	0
25 - 30	0.0	0	0	-30,000	20	470	596.2	0	0	0.0	0	0
30 - 35	0.0	0	0	-35,000	12	275	695.6	0	0	0.0	0	0
35 - 40	0.0	0	0	-40,000	9	208	794.9	0	0	0.0	0	0
40 - 45	0.0	0	0	-45,000	10	239	894.3	0	0	0.0	0	0
45 - 50	0.0	0	0	-50,000	0	0	993.7	0	0	0.0	0	0
50 - 55	0.0	0	0	-55,000	0	0	1,093.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-60,000	0	0	1,192.4	0	0	0.0	0	0
60 - 65	0.0	0	0	-65,000	0	0	1,291.7	0	0	0.0	0	0
65 - 70	0.0	0	0	-70,000	0	0	1,391.1	0	0	0.0	0	0
70 - 75	0.0	0	0	-75,000	0	0	1,490.5	0	0	0.0	0	0
75 - 80	0.0	0	0	-80,000	0	0	1,589.8	0	0	0.0	0	0
80 - 85	0.0	0	0	-85,000	0	0	1,689.2	0	0	0.0	0	0
85 - 90	0.0	0	0	-90,000	0	0	1,788.6	0	0	0.0	0	0
90 - 95	0.0	0	0	-95,000	0	0	1,887.9	0	0	0.0	0	0
95 - 100	0.0	0	0	-100,000	0	0	1,987.3	100	7,751	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,425	0.0	0	1,009	0.0	0	8.760

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	1,027	4	196	1
Feb	919	4	150	1
March	925	4	78	0
April	764	4	14	0
May	786	4	0	0
June	781	4	0	0
July	728	4	0	0
Aug	815	4	0	0
Sept	723	4	0	0
Oct	823	4	15	0
Nov	832	4	84	0
Dec	911	4	148	1
Total	10,034	4	685	1

Building Energy Consumption = Source Energy Consumption =

51,701 (Btu/Sq Ft/Year) 52,767 (Btu/Sq Ft/Year) Floor Area =

1,987 (Sq Ft)

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Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

V 600 PAGE 2

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2

Ref	Equip	•••••				Nont	thly Cons							
Num	Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
0	LIGHTS													
	ELEC	757	685	815	723	786	781	728	815	723	786	723	728	9,053
	PK	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
1	MISC LD													
	ELEC	0	0	` 0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	MISC LD													
	GAS	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	MISC LD													
	OIL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	MISC LD													
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	MISC LD													
	P HOTH20	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	MISC LD													
	P CHILL	0.	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	EQ2454		RESI	ENT GAS	FURNACE	W-FAN								
	GAS -	196	150	78	14	0	0	0	0	0	15	84	148	685
	PK .	0.7	0.7	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.6	0.7
	E95254			ENTIAL F	URNACE I	AN								
	ELEC	270	234	110	41	0	0	0	0	0	37	108	182	982
	PK	0.4	0.4	0.4	0.4	0.0	0.0	0.0	0.0	0.0	n 4	0.4	0.4	0.7

EQUIPMENT ENERGY CONSUMPTION -----

3443411

Sub Total

Grand Total

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UTILITY PEAK CHECKSUMS - ALTERNATIVE 2	
UTILITY PEAK CHECKSUMS	
Utility ELECTRIC DEMAND	
Peak Value 4.3 (kW) Yearly Time of Peak 9 (hr) 1 (mo)	
Hour 9 Month 1	
Sub Total 0.0 0.00	
Heating Equipment	
1 EQ2454 RESIDENT GAS FURNACE W-FAN 0.4 8.58	
Sub Total 0.4 8.58	
Sub Total 0.0 0.00	
Sub Total 0.0 0.00	
Miscellaneous	
Lights 4.0 91.42 Base Utilities 0.0 0.00 Misc Equipment 0.0 0.00	

D1-21

4.0 91.42

4.3 100.00

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION: Whit	a Canda Missila	Dange	BECION:	4	PPO IFOT NO.	
				e Hange DG.1830 – LOWER CEILI	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		DISCRETE PORTIO		TOTAL	INGS		FISCAL YEAR:	1992
		ANALYSIS DATE:	06/04/92	TOTAL	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
		ANALI GIO DAIL.	0004782		ECONOMIC EN E.	25	FREFARED BT.	A. STOVER
1	IN۱	/ESTMENT						
	A.	CONSTRUCTION	COST	=			\$93,109	
	В.	SIOH COST		(5.5% of 1A) =			\$5,121	
	C.	DESIGN COST		(6.0% of 1A) =			\$5,587	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$103,816	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$103,816
2	EN	ERGY SAVINGS (+)						
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
		F: F0	\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
		ELEC	\$18.37	(2)	, ,		(\$584)	
		NAT GAS	60.04	0	\$0	17.28	\$0	
		PAPER	\$2.21	69	\$152	19.64	\$2,995	
		COAL		ŭ	\$0 \$0	16.22	\$0 \$0	
		TOTAL		67	114,1	16.22	\$0 >	\$ 2,410
				.	114.1			\$2,410
3	NO	N-ENERGY SAVIN	GS (+) / COST ((-)				
	A.	ANNUAL RECURR	ING (+/-) (ELE	C. DEMAND SAVINGS)	=		(\$234)	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	AVINGS (+) / C	OST (-)	(3A x 3A1) =		(\$3,435)	
	В.	NON-RECURRING	à (+/–)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
			-	SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. EQUIP REPLAC	EMENT COST	\$23,770	10	0.64	\$ 15,213	
		b.		\$0		0.00	\$0	
		c. d TOTAL		\$0		0.00	\$0	
	С		RGY DISCOUN	\$23,770 ITED SAVINGS (+) / COS	T (_)	(240 + 2044)	\$15,213	644 7776
		PROJECT NON-EI		11LD 3AVINGS (+) 1 COS	, (-)	(3A2 + 3Bd4) =		\$11,778
	٠.	1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$ 795	
		a IF 3D1 => 3C T				(21 0 x 0.56) =	4 785	
		b IF 3D1 < 3C TH	IEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =	0.03	•
		c IF 3D1b => 1 T		•		(==	3,00	
		d IF 3D1b < 1 TH	IEN PROJECT	DOES NOT QUALIFY				
4	FIR	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$831
		TAL NET DISCOUN				(2F5 + 3C) =		\$14,188
6		SCOUNTED SAVING				(5/1F) =		0.14
~		F SIR < 1 THEN PRO		OT QUALIFY)				
′	211/	MPLE PAYBACK (SP	6)			(1F/4) =		124.94

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NWC							
CONTRACTOR	REMC ENGINEERS INC.			ADDRESS 2750 SO	UTH WADSW	ORTH BLV	D., #C-200.	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	0 80227	
CONTRACT F	CONTRACT FOR (Work to be performed) LOWER CEILING — BLDG 1830						PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE F	PURCHASE REQUEST NUMBER			PROJECT NUMBER	18ER		WORK LOCATION WHITE SAN	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
				MATERIAL COST	A. COST		LABOR COSTS			
Line	Item	Unit of Measure	Quantity	<u>.</u>	Total	Manhours	Average	Total	Other	Line
	(1)	(2)	(3)	4	(5)	(6)		- Otal	sis 6	(10)
	SUSPENDED CEILING W/ 2'x4'x3/4" PANELS	SF	6383	1.10	7021.3	0.05	35.55	4765.23		\$11,786.53
	FLUOR. LAMPS / TROFFERS IN CEILING GRID	EA	129	65.00	8385.00	1.51	38.95	7582.05		\$15,967.05
	INSTALL GAS FURNANCES	EA	3	3581	10743.00	32.00	35.73	3430.08		\$14,173.08
	EXTEND EXSTNG & ADD NEW GALV. DUCT	LBS	8200	1	4428.00	0.08	37.05	25520.04		\$29,948.04
	INSULATE DUCTWORK	SF	6333	0	2849.85	0.04	36.15	9615.39		\$12,465.24
	SUPPLY AIR DIFFUSERS	EA	52	56	2912.00	0.67	39.70	1376.95		\$4,288.95
	DEMOLITION	EA	-			160.00	28.00	4480.00		\$4,480.00
	TOTAL									\$93,108.89
	Source: Means Electrical, Mechanical, & Construction Cost Data, 1992; Material prices include 25 % overhead & profit; Labor rates include overhead & profit	aterial prices inclu	de 25 % overhead	d & profit; Labor	rates include overhead	i & profit				

PAGE 1

ESOS STUDY AT WSMR - BUILDING 1830
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
LOWER CEILING - ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO	. v
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)
Design Simulation Period: May	To	October .

Time/Date Program was Run: 19:50:54 2/ 4/92 Dataset Name: 1830 .TM

System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

System '	1	Block	UH	•	UNIT	HEATERS
----------	---	-------	----	---	------	---------

Peaked a	at Time =	=>	Mo/Hr:	0/ 0				* Mc	/Hr:	0/0	•	Mo/Hr:	13/1	
Outside	Air ==>	Q,	ADB/WB/HR:	0/ 0/ 0.	.0				ADB:	0 1		CADS:		
										1	,	<i>.</i>		
		Space	Ret. Air	Ret. Air	Ne	t Pe	ercnt	* s	pace	Percnt 1	Space F	Peak Coi	l Peak	Percn
		Sens.+Lat.	Sensible	Latent	Tota	al Of	Tot		ible	Of Tot	-		t Sens	Of To
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh	1)	(%)	* (8	ituh)	(%)			(Btuh)	(%
Skylit	te Solr	0	0			0	0.00	ŧ	0	0.00	•	0	0	0.0
Skylit	te Cond	0	0			0	0.00	•	0	0.00	,	0	0	0.0
Roof C	Cond	0	0			0	0.00	•	0	0.00	-17.	.626 -	17,626	7.0
Glass	Solar	0	0			0	0.00	*	0	0.00	-	0	0	0.0
Glass	Cond	0	o			0	0.00		0	0.00	-22,	192 -	22,192	8.8
Wall C	Cond	0	0			0	0.00	•	0	0.00			3,554	41.2
Partit	ion	0					0.00	•	0	0.00	-	0	0	0.00
Expose	ed Floor	0					0.00	.	0	0.00	-19,	-	19,485	7.7
Infilt	ration	0					0.00		Ö	0.00	•		38,133	35.1
Sub To	tal==>	0	0				0.00	b	Ö	0.00			0,990	100.0
Internal	Loads					-	,	,	•	1		.,,,,	,0,,,0	100.00
Lights	3	0	0			0	0.00	b	0	0.00	•	0	0	0.00
People	:	0					0.00		Ō	0.00	•	0	0	0.00
Misc		0	0	0			0.00	•	0	0.00	•	0	0	0.00
Sub To	tal==>	0	0	0			0.00	•	0	0.00		0	0	0.00
Ceiling	Load	0	0				0.00		٥	0.00		0	0	0.00
Outside	Air	0	0	0			0.00	,	0	0.00	,	0	0	0.00
Sup. Fan	Heat						0.00	•	•	0.00		•	0	
Ret. Fan	Heat		0				0.00	•		0.00	•		0	0.00
Duct Hea	t Pkup		0				0.00	,		0.00	•		0	0.00
OV/UNDR	Sizing	0					0.00	+	0	0.00		0	0	0.00
Exhaust	Heat		0	0			0.00	•	-	0.00		•	0	0.00
Terminal	Bypass		0	0			0.00	•		0.00			0	0.00
								•		4				0.00
Grand To	tal==>	0	0	0		0 (0.00	P	0	0.00	-250,	990 -25	0,990	100.00
											•		-,	
				ING COIL S	ELECTION		•••••				•••••••	AREAS		
		Capacity	Sens Cap.	Coil Airfl	Enter	ing Di	B/WB/HF	Lea Lea	ving Di	B/WB/HR	Gross To	tal G	ass (sf	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F D	eg F	Grains	Deg F	Deg F	Grains	Floor	14,688		
lain Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Part	1,600		
ux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Exflr	558		
opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	7,344		0 0
otals	0.0	0.0									Wall	6,553	3	69 6
			ECTION		A					ENGINEERING	CHECKS	TEMPE	RATURES	(F)
	Capacit	•		Lvg	Туре	Cool	ling	Heating		g % OA	0.0	Type	Clg	Htg
_1	(Mbh)	-	-	Deg F	Vent		0	0		g Cfm/Sqft	0.00	SADB	0.0	109.5
ain Htg	-393.	•	800 49.1	109.5	Infil		0	1,958		g Cfm/Ton	0.00	Plenum	0.0	72.0
ux Htg	0.		0 0.0	0.0	Supply		0	6,800		g Sqft/Ton	0.00	Return	0.0	71.0
reheat	0.		0.0	0.0	Mincfm		0	0		Btuh/Sqft	0.00	Ret/OA	0.0	71.0
eheat :dif	0.		0.0	0.0	Return		0	6,800	No.	. People	0	Runarno	0.0	72.0
umidif	0.		0.0	0.0	Exhaust		0	. 0		3 % OA	0.0	Fn MtrT	D 0.0	0.1
pt Vent	0.		0 0.0	0.0	Rm Exh		0	0	Htg	g Cfm/SqFt	0.46	Fn BldT	D 0.0	0.1
otal	-393.)			Auxil		0	0	Htc	Btuh/SqFt	-26.78	Fn Fric	t 0.0	0.2

System 2 Block RAD - RADIATION

Peaked at	Time ==>		Mo/Hr: (0/ 0			*	Mo/H	r: 0	/ 0 *		Mo/Hr: 13	3/ 1	
Outside A	ir ==>	OAI	B/WB/HR:	0/ 0/ 0.	0		*	CAD	B:	0 *		OADB:		
		C	D.A. 45-	D-4 4:-	N - A		*	_		*				_
	Sen	Space s.+Lat.	Ret. Air Sensible	Ret. Air Latent	net Total	Percnt Of Tot	-	Spa		Percnt *	Space Per			Percnt
Envelope		(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	Sensib (Btu		Of Tot * (%) *	Space Ser			Of Tot
Skylite		0	0	(Btull)	(5(4))	0.00	*	(500	0	0.00 *	(Btul	0	tuh) O	(%) 0.00
Skylite		0	0		0	0.00	*		0	0.00 *		0	0	0.00
Roof Co		Ö	0		0	0.00			0	0.00 *			.237	8.81
Glass S		0	0		0	0.00			0	0.00 *	•	,, -u 0	, <i>بے</i> ,	0.00
Glass C		0	0		0	0.00	*		0	0.00 *		-	.016	13.92
Wall Co	nd	0	0		0	0.00	*		0	0.00 *	•		,823	38.30
Partiti	on	0			0		*		0	0.00 *		0	0	0.00
Exposed	Floor	0			0	0.00			0	0.00 *	•	0	0	0.00
Infiltr	ation	0			0	0.00			0	0.00 *		-	,446	38.97
Sub Tot	:al==>	0	0		0	0.00	*		0	0.00 - *	•		,522	100.00
Internal	Loads						*		_	*	•		,	,,,,,,,
Lights		0	0		0	0.00	*		0	0.00 *		0	0	0.00
People		0			0		*		0	0.00 *		0	0	0.00
Misc		0	0	0	0	0.00	*		0	0.00 *		0	0	0.00
Sub Tot	:al==>	0	0	0	0	0.00	*		0	0.00 *	ı	0	0	0.00
Ceiling L	.oad	0	0		0	0.00	*		0	0.00 *	,	0	0	0.00
Outside A	ir	0	0	0	0	0.00	*		0 `	0.00 *		0	0	0.00
Sup. Fan	Heat				0	0.00	*			0.00 *	•		0	0.00
Ret. Fan	Heat		0		0	0.00	*			0.00 *	,		0	0.00
Duct Heat	: Pkup		0		0	0.00	*			0.00 *	•		0	0.00
OV/UNDR S	Sizing	0			0	0.00	*		0	0.00 *	•	0	0	0.00
Exhaust H	leat		0	0	0	0.00	*			0.00 *	!		0	0.00
Terminal	Bypass		0	0	0	0.00	*			0.00 *			0	0.00
		_	_	_	_		*			*				
Grand Tot	al==>	0	0	0	0	0.00	*		0	0.00 *	-93,5	22 -93	,522	100.00
••••••			coo		SELECTION							AREAS-		
	Total Ca		Sens Cap.			ng DB/WB	/HR	Leavi	ing DB	/WB/HR	Gross Tota	al Gla	ss (sf	(%)
•	(Tons)	(Mbh)	(Mbh)	(cfm)		g F Gra			-	Grains	Floor	7,488		
Main Clg	0.0	0.0	0.0	0			0.0	0.0	0.0	0.0	Part	600		
Aux Clg	0.0	0.0	0.0	0			0.0	0.0	0.0	0.0	ExFlr	0		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	3,744		0 0
Totals	0.0	0.0									Wall	2,543	2	235 9
	HEATING	COIL SELI	ECTION		AI	RFLOWS (cfm)		E	NGINEERING	CHECKS	TEMPER	ATURES	(F)
	Capacity	Coil A	irfl Ent	Lvg	Туре	Cooling		Heating	Clg	% OA	0.0	Type	Clg	Htg
	(Mbh)	(cfi	•	_	Vent	0		0	Clg	Cfm/Sqft	0.00	SADB	0.0	68.1
Main Htg	-382.5		0.0		Infil	0		874	Clg	Cfm/Ton	0.00	Plenum	0.0	68.0
Aux Htg	0.0		0.0		Supply	0		0	Clg	Sqft/Ton	0.00	Return	0.0	68.0
Preheat	0.0		0 0.0		Mincfm	0		0	Clg	Btuh/Sqft	0.00	Ret/OA	0.0	68.0
Reheat	0.0		0 0.0		Return	0		0		Peopl e	0	Runarnd	0.0	68.0
Humidif	0.0		0 0.0		Exhaust	0		0		% OA	0.0	Fn MtrTD	0.0	0.0
Opt Vent	0.0		0 0.0	0.0	Rm Exh	0		0	Htg	Cfm/SqFt	0.00	Fn 8ldTD	0.0	0.0
Total	-382.5				Auxil	0		0	Htg	Btuh/SqFt	-51.08	Fn Frict	0.0	0.0

V 600 PAGE

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1830

(At time of Coil Peak)

			Supply	Return	System		·· Heatin System				Run		System
			Fan	Fan	Exhaust		Exhaust	Exhaust	Ducted	Plenum	Around	Corridr	Return
Room			Heat	Heat	Heat Loss	Total	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow
Number		escription	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)
1	ROOM	1	0	0	0	0	0	0	0	0	0	0	3,400
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	
Zone	1	Block	0	0	0	0	0	0	0	0	0	0	3,400
2	ROOM	2	0	0	0	0	0	0	0	0	0	0	3,400
Zone	2	Total/Ave.	0	0	0	0	0	.0	0	8	0	0	3,400
Zone	2	Block	0	0	0	0	0	0	0	0	0	0	3,400
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	6,800
System	1	Block	0	0	0	0	0	0	0	0	0	0	6,800
3	ROOM	3	0	0	0	0	0	0	0	0	0	0	C
Zone	3	Total/Ave.	0	Ò	0	0	0	0	0	0	0	0	C
Zone	3	Block	0	0	0	0	0	0	0	0	0	0	0
4	ROOM	4	0	0	0	0	0	0	0	0	0	0	0
Zone	4	Total/Ave.	0	0	6	0	0	0	0	0	0	0	C
Zone	4	Block	0	0	0	0	0	0	0	0	0	0	0
System	2	Total/Ave.	0	0	0	0	0	0	0	0	C	0	0
System	2	Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1830

-----BUILDING U-VALUES-----

		••••	Room U-Values								Room	Room	
					(Btu	/hr/sqf	t/F)				Mass	Capac.	
Room				Summr	Wintr		Summe	Wintr			(lb/	(Btu/	
Number	Description	on Part.	Exflr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)	
1	ROOM 1	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.358	0.000	37.3	7.46	
Zone	1 Total	/Ave. 0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.358	0.000	37.3	7.46	
2	ROOM 2	0.000	0.750	0.000	0.000	0.050	1.140	1.259	0.358	0.000	78.3	16.56	
Zone	2 Total	/Ave. 0.000	0.750	0.000	0.000	0.050	1.140	1.259	0.358	0.000	78.3	16.56	
System	1 Total	/Ave. 0.388	0.750	0.000	0.000	0.050	1.140	1.259	0.358	0.000	57.8	12.01	
3	ROOM 3	0.388	0.000	0.000	0.000	0.000	1.140	1.259	0.358	0.000	31.5	6.30	
Zone	3 Total	/Ave. 0.388	0.000	0.000	0.000	0.000	1.140	1.259	0.358	0.000	31.5	6.30	
4	ROOM 4	0.000	0.000	0.000	0.000	0.050	1.140	1.259	0.358	0.000	74.1	15.71	
Zone	4 Total	/Ave. 0.000	0.000	0.000	0.000	0.050	1.140	1.259	0.358	0.000	74.1	15.71	
System	2 Total	/Ave. 0.388	0.000	0.000	0.000	0.050	1.140	1.259	0.358	0.000	52.8	11.01	
Buildin	g	0.388	0.750	0.000	0.000	0.050	1.140	1.259	0.358	0.000	56.1	11.67	

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1830

------ BUILDING AREAS ------

Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	ROOM 1	1	1	7,344	7,344	1,600	. 402	0	0	0	38	1	3,781
Zone	1 Total/Ave	•			7,344	1,600	402	0	0	0	38	1	3,781
2	ROOM 2	1	1	7,344	7,344	0	156	0	0	7,344	3 31	12	2,403
Zone	2 Total/Ave				7,344	0	156	0	0	7,344	. 331	12	2,403
System	1 Total/Ave				14,688	1,600	558	0	0	7,344	369	6	6,184
3	ROOM 3	1	1	3,744	3,744	600	0	0	0	0	15	1	1,467
Zone	3 Total/Ave				3,744	600	0	0	0	0	15	1	1,467
4	ROOM 4	1	1	3,744	3,744	0	0	0	0	3,744	220	21	840
Zone	4 Total/Ave				3,744	0	0	0	0	3,744	220	21	840
System	2 Total/Ave	•			7,488	600	0	0	0	3,744	235	9	2,308
Buildir	ng				22,176	2,200	558	0	0	11,088	604	7	8,491

------SYSTEM LOAD PROFILE------

System Totals

Percent	Cool	ing Loa	d	Heatir	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-38,792	24	681	340.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-77,584	27	780	680.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-116,375	23	649	1,020.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-155,167	17	483	1,360.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-193,959	9	266	1,700.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-232,751	0	0	2,040.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-271,543	0	0	2,380.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-310,334	0	0	2,720.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-349, 126	0	0	3,060.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-387,918	0	0	3,400.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-426,710	0	0	3,740.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-465,502	0	0	4,080.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-504,293	0	0	4,420.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-543,085	0	0	4,760.0	C	0	0.0	0	0
70 - 75	0.0	0	0	-581,877	0	0	5,100.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-620,669	0	0	5,440.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-659,461	0	0	5,780.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-698,253	0	0	6,120.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-737,044	0	0	6,460.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-775,836	0	0	6,800.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	5,901	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

 MUNIHLT	ENERGY	CONSUMPTION	

	ELEC	DEMAND	GAS	GAS DHND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	5,695	28	1,466	5
Feb	5,150	28	1,108	5
March	5,897	28	279	3
April	5,085	28	0	1
May	5,527	28	0	0
June	5,493	28	0	0
July	5,119	28	0	0
Aug	5 ,7 31	28	0	0
Sept	5,085	28	0	0
Oct	5,527	28	0	0
Nov	5,413	28	290	2
Dec	5,481	28	1,077	4
Total	65,205	28	4,221	5

Building Energy Consumption = 29,071 (Btu/Sq Ft/Year) Source Energy Consumption = 29,660 (Btu/Sq Ft/Year)

Floor Area = 22,176 (Sq Ft)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

Grand Total

UTILITY PEA	K CHECKSUMS	· • •
Utility ELECTRIC DEMAND		
Peak Value 28.4 (kW)		
Yearly Time of Peak 9 (hr) 1 (mo)		
Hour 9 Month 1		
Sub Total	0.0 0.00	
Heating Equipment		
1 EQ2201 GAS FIRED UNIT HEATER	0.5 1.76	
Sub Total	0.5 1.76	
Sub Total	0.0 0.00	
Sub Total	0.0 0.00	
Miscellaneous		
Lights	27.9 98.24	_
Base Utilities	0.0 0.00	
Misc Equipment	0.0 0.00	
Sub Total	27.9 98.24	

28.4 100.00

ESOS STUDY AT WSMR - BUILDING 1830
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
LOWER CEILING - ALT 1-BSLN, ALT2-ECO

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 3,918 (ft) Elevation: Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 5:46:36 2/ 4/92 Dataset Name: 1830 .TM 1 Block UH - UNIT HEATERS

System

Burney to Br

			COOLING COIL		******	*****	*****				****** HE			****
	t Time =			0/ 0	_					0/0	*	Mo/Hr:		
Outside	AIR ==>	OA	DB/WB/HR:	0/ 0/ 0.	0			* C	ADB:	0 '	* •	OADB:	24	
		Space	Ret. Air	Ret. Air	W	et Pe	rent	- * c	pace	Percnt '	* Space P	lask Cai	l Peak	Percni
		Sens.+Lat.	Sensible		Tota				ible	Of Tot	•		t Sens	Of Tot
Envelope		(Btuh)	(Btuh)	(Stuh)	(Btui				tuh)	(%)	•		(Btuh)	(%)
	e Solr	0	0		(512	0		*	0	0.00		0	0	0.00
Skylit		0	0			-	0.00	*	0	0.00		0	0	0.0
Roof C	ond	0	0				0.00	*	0	0.00	· -13,	550 -	13,550	5.8
Glass	Solar	0	0			0	0.00	*	0	0.00	-	0	. 0	0.00
Glass	Cond	0	0			0	0.00	*	0	0.00	-19,	289 -	19,289	8.3
Wall C	ond	0	0			0	0.00	*	0	0.00	-97,	532 -	97,532	42.29
Partit	ion	0				0	0.00	*	0	0.00	*	0	0	0.00
Expose	d Floor	0				0	00.0	*	0	0.00	-18,	666 -	18,666	8.09
Infilt	ration	0				0	0.00	*	0	0.00	-81,	570 -	31,570	35.37
Sub To	tal==>	0	0			0	0.00	*	0	0.00	-230,	607 -2	30,607	100.00
Internal	Loads							*		•	·			
Lights		0	0			0	0.00	*	0	0.00	•	0	. 0	0.00
People		0				0	0.00	•	0	0.00	•	0	0	0.00
Misc		0	0	0		0	0.00	*	0	0.00	•	0	0	0.00
Sub To	tal==>	0	0	0		0	0.00	•	0	0.00	•	0	0	0.00
Ceiling		0	0			0	0.00	*	0	0.00	•	0	0	0.00
Outside /		0	0	0				*	0	0.00	•	0	0	0.00
Sup. Fan			_				0.00	.		0.00	•		0	0.00
Ret. Fan			0				0.00			0.00			0	0.00
Duct Hear	•	•	0				0.00		-	0.00		_	0	0.00
OV/UNDR	-	0					0.00		0	0.00		. 0	0	9
Exhaust 1			0	0			0.00			0.00 *			0	0.00
Terminal	pypass		U	U		0	0.00	•		0.00	•		0	0.00
Grand To	tal==>	0	0	0		0	0.00	*	0	0.00	-230,	607 -23	80,607	100.00
			cool	.ING COIL S	ELECTION							AREAS	}	
	Total	Capacity	Sens Cap.	Coil Airfl	Enter	ing D	B/WB/HI	R Lea	ving DI	B/WB/HR	Gross To	tal G	ass (sf	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F D	eg F	Grain	s Deg F	Deg F	Grains	Floor	14,688		
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.1	0.0	0.0	0.0	Part	1,600		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.1	0.0	0.0	0.0	Exflr	558		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	7,344		0 0
Totals	0.0	0.0									Wall	6,553	3	69 6
• • • • • • • • • • • • • • • • • • • •	HEATIN	G COIL SELI	ECTION		A	IRFLO	WS (cfi	n)	{	ENGINEERING	CHECKS	TEMPE	RATURES	(F)
	Capacit	•	irfl Ent	Lvg	Type	Coo	ling	Heating	Cle	% OA	0.0	Type	Clg	Htg
	(Mbh)		-	Deg F	Vent		0	. 0		Cfm/Sqft	0.00	SADB	0.0	102.9
lain Htg	-393.	•	800 42.5	102.9	Infil		0	1,958		Cfm/Ton	0.00	Plenum	0.0	
Aux Htg	0.		0.0	0.0	Supply		0	6,800		Sqft/Ton	0.00	Return	0.0	
reheat	0.		0.0	0.0	Mincfm		0	0		Btuh/Sqft		Ret/OA	0.0	
Reheat	0.		0.0	0.0	Return		0	6,800		People	0	Runarno		
lumidif	0.		0.0	0.0	Exhaust		0	0		% OA	0.0	Fn Mtrï		
Opt Vent	0.		0 0.0	0.0	Rm Exh		0	0		Cfm/SqFt	0.46	Fn BldT		
otal	-393.	۵			Auxil		0	0	Htg	; Btuh/SqFt	-26.78	Fn Fric	t 0.0	0.3

System 2 Block UH - UNIT HEATERS

			COOLING COIL			*****	020	SPACE		***** HEA	TING COIL		
Peaked at Outside A			Mo/Hr: ADB/WB/HR:	0/0	n			-)/0 * 0 *		Mo/Hr: 1 OADB:	-	
outstuc P		O.	100, WO, III.	0, 0, 0.	•		*				5,150.		
•		Space	Ret. Air	Ret. Air	Net	Percnt	* s	pace	Percnt *	Space Pe	ak Coil	Peak	Percnt
	,	Sens.+Lat.	Sensible		Total	Of Tot		ible	Of Tot *	Space Se	ns Tot	Sens	Of Tot
Envelope		(Btuh)	(Btuh)		(Btuh)	(%)		tuh)	(%) *	•		tuh)	(%)
Skylite		0	(0	0.00	*	0	0.00 *		0	0	0.00
Skylite		0	(0	0.00	*	0	0.00 *		0	0	0.00
Roof Co		0	()	0	0.00	*	0	0.00 *	-6,9	08 -6	,908	7.53
Glass S	olar	0	C	1	0	0.00	*	0	0.00 *	·	0	0	0.00
Glass (ond	0	(1	0	0.00	*	0	0.00 *	-12,2	42 -12	,242	13.35
Wall Co	ond	0	C)	0	0.00	*	0	0.00 *	-		,496	39.78
Partiti		0			0	0.00	•	0	0.00 *	-	0	. 0	0.00
Exposed	floor	0			.0	0.00	*	0	0.00 *		0	0	0.00
Infilt		0			0	0.00	*	0	0.00 *	-36,0	88 -36	,088	39.34
Sub Tot		0	(1	0	0.00	•	0	0.00 *	-91,7		,734	100.00
Internal		•	•		· ·		*	•	*		• • • • • • • • • • • • • • • • • • • •	,	
Lights		0	()	0	0.00	*	0	0.00 *		0	0	0.00
People		0	_		0	0.00	*	0	0.00 *		0	0	0.00
Misc		0	(0	0	0.00	*	0	0.00 *		0	0	0.00
Sub Tot	al==>	. 0	Č		0	0.00	*	0	0.00 *		0	0	0.00
Ceiling L		0	Č	•	0	0.00		0	0.00 *		0	0	0.00
Outside /		0	. (0	0.00	*	0	0.00 *		0	Ō	0.00
Sup. Fan		•	•	,	0	0.00	*	•	0.00 *		•	0	0.00
Ret. Fan			(1	0	0.00	*		0.00 *			0	0.00
Duct Heat			ì		0	0.00	*		0.00 *			0	0.00
OV/UNDR S		0	`	•	0	0.00	*	0	0.00 *		0	0	0.00
Exhaust I	-	•	(0	0	0.00	*	•	0.00 *		·	0	0.00
Terminal			ì		0	0.00	*		0.00 *			0	0.00
	-,,,,,,,,,				•		*		*			•	0.00
Grand Tot	:al==>	0		0	0	0.00	*	0	0.00 *	-91,7	34 -91	,734	100.00
				LING COIL S				• • • • • • • • • • • • • • • • • • • •			AREAS-		• • • • • • • • • • • • • • • • • • • •
		Capacity	Sens Cap.	Coil Airfl		ng DB/WB/		ving DB		Gross Tot		ss (sf) (%)
4-i- Cl-	(Tons)	(Mbh)	(Mbh)	(cfm)		g F Grai	-	Deg F	Grains	Floor	7,488		
Main Clg	0.0	0.0	0.0	0			0.0	0.0	0.0	Part	600		
Aux Clg	0.0	0.0	0.0	0			0.0	0.0	0.0	Exflr	0		
opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	Roof	3,744		0 0
Totals	0.0	0.0								Wall	2,543	2.	35 9
	HEATI	IG COIL SEL	ECTION		AI	RFLOWS (d	fm)	E	NGINEERING	CHECKS	TEMPER	ATURES	(F)
	Capacit	ty Coil A	irfl Ent	Lvg	Type	Cooling	Heating		% OA	0.0	Туре	Clg	Htg
	(Mbh)				Vent	Ō	0	_	Cfm/Sqft	0.00	SADB	0.0	
lain Htg	-382	-	821 -99.4		Infil	0	874	-	Cfm/Ton	0.00	Plenum	0.0	
Aux Htg	0.	-	0 0.0		Supply	0	1,821	_	Sqft/Ton	0.00	Return	0.0	
reheat	0.		0 0.0		Mincfm	0	0		Btuh/Sqft		Ret/OA	0.0	
-	0.		0 0.0		Return	0	1,821	_	People	0	Runarnd	0.0	
Reheat		-		3.0			,,021		=	•	Name I II	٠.٠	
Reheat Iumidif	0.	.0	0 0.0	0.0	Exhaust	U	n	l Hta	1 % OA	0.0	Fn MtrTn	በበ	(1 7
Reheat Humidif Opt Vent	0. 0.		0 0.0		Exhaust Rm Exh	0	0	_	% OA Cfm/SqFt	0.0 0.24	Fn MtrTD Fn BldTD	0.0 0.0	

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2 LOWER CEILINGS, BLDG. 1830

							- Heatin	g					
			Supply	Return	System		System	Room			Run		System
			Fan	Fan	Exhaust		Exhaust	Exhaust	Ducted	Plenum	Around	Corridr	Return
Room			Heat	Heat	Heat Loss	Total	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow
Number	i	Description	(Btuh)	(Btuh)	(Stuh)	(Btuh)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)
1	ROOM	1	0	0	0	0	0	0	0	0	0	0	3,400
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	3,400
Zone	1	Block	0	0	0	0	0	0	0	0	0	0	3,400
2	ROOM	2	0	0	0	0	0	0	0	0	0	0	3,400
Zone	2	Total/Ave.	. 0	0	0	0	0	0	0	0	0	0	3,400
Zone	2	Block	0	0	0	0	0	0	0	0	0	0	3,400
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	6,800
System	1	Block	0	0	0	0	0	0	0	0	0	0	6,800
3	ROOM	3	0	0	0	0	0	0	0	0	0	0	867
Zone	3	Total/Ave.	0	0	0	0	0	0	0	0	0	0	867
Zone	3	Block	0	0	0	0	0	0	0	0	0	0	867
4	ROOM	4	0	0	0	0	0	0	0	0	0	0	954
Zone	4	Total/Ave.	0	0	0	0	0	0	0	0	0	0	954
Zone	4	Block	0	0	0	0	0	0	0	0	0	0	954
System	2	Total/Ave.	0	0	0	0	0	0	0	0	0	0	1,821
System	2	Block	0	0	0	0	0	0	0	0	0	0	1,821

BUILDING U-VALUES - ALTERNATIVE 2 LOWER CEILINGS, BLDG. 1830

(មិនដែលមួយនេះ

------ BUILDING U-VALUES-----

						Roc	m U-Val	.ues				Room	Room
						(Btu	ı/hr/sqf	t/F)				Mass	Capac.
Room					Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Des	cription	Part.	Exflr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	ROOM	1	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.358	0.000	37.3	7.46
Zone	1	Total/Ave.	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.358	0.000	37.3	7.46
2	ROOM	2	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.358	0.000	78.3	16.56
Zone	2	Total/Ave.	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.358	0.000	78.3	16.56
System	1	Total/Ave.	0.388	0.750	0.000	0.000	0.045	1.140	1.259	0.358	0.000	57.8	12.01
3	ROOM	3	0.388	0.000	0.000	0.000	0.000	1.140	1.259	0.358	0.000	31.5	6.30
Zone	3	Total/Ave.	0.388	0.000	0.000	0.000	0.000	1.140	1.259	0.358	0.000	31.5	6.30
4	ROOM	4	0.000	0.000	0.000	0.000	0.045	1.140	1.259	0.358	0.000	74.1	15.71
Zone	4	Total/Ave.	0.000	0.000	0.000	0.000	0.045	1.140	1.259	0.358	0.000	74.1	15.71
System	2	Total/Ave.	0.388	0.000	0.000	0.000	0.045	1.140	1.259	0.358	0.000	52.8	11.01
Buildin	g		0.388	0.750	0.000	0.000	0.045	1.140	1.259	0.358	0.000	56.1	11.67

BUILDING AREAS - ALTERNATIVE 2 LOWER CEILINGS, BLDG. 1830

				Floor	Total		Exposed						
	•	Numb	er of	Area/Dupl	Floor	Partition	Floor	Skylight	Skl	Net Roof	Window	Win	Net Wall
Room		Dupl	icate	Room	Area	Area	Area	Area	/Rf	Area	Area	/WL	Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	ROOM 1	1	1	7,344	7,344	1,600	402	0	0	0	38	1	3,781
Zone	1 Total/Ave.				7,344	1,600	402	0	0	0	38	1	3,781
2	ROOM 2	1	1	7,344	7,344	0	156	0	0	7,344	331	12	2,403
Zone	2 Total/Ave.				7,344	0	156	0	0	7,344	331	12	2,403
System	1 Total/Ave.				14,688	1,600	558	0	0	7,344	369	6	6,184
3	ROOM 3	1	1	3,744	3,744	600	0	0	0	0	15	1	1,467
Zone	3 Total/Ave.				3,744	600	0	0	0	0	15	1	1,467
4	ROOM 4	1	1	3,744	3,744	0	0	0	0	3,744	220	21	840
Zone	4 Total/Ave.				3,744	0	0	0	0	3,744	220	21	840
System	2 Total/Ave.				7,488	600	0	0	0	3,744	235	9	2,308
Buildin	g				22,176	2,200	558	0	0	11,088	604	7	8,491

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

------SYSTEM LOAD PROFILE -------

System Totals

Percent	Cool	ing Loa	ad	Heati	ng Load		Cooling	Airflo	4	Heating	Airflo	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-38,792	31	746	431.0	0	0	0.0	. 0	0
5 - 10	0.0	0	0	-77,584	24	587	862.1	0	0	0.0	0	0
10 - 15	0.0	0	0	-116,375	21	509	1,293.1	0	0	0.0	0	0
15 - 20	0.0	0	0	-155,167	18	430	1,724.1	0	0	0.0	0	0
20 - 25	0.0	0	0	-193,959	6	150	2,155.2	0	0	0.0	0	0
25 - 30	0.0	0	0	-232,751	0	0	2,586.2	0	0	0.0	0	0
30 - 35	0.0	0	0	-271,543	0	0	3,017.3	0	0	0.0	0	0
35 - 40	0.0	0	0	-310,334	0	0	3,448.3	0	0	0.0	0	0
40 - 45	0.0	0	0	-349,126	0	0	3,879.3	0	0	0.0	0	0
45 - 50	0.0	0	0	-387,918	0	0	4,310.4	0	0	0.0	0	0
50 - 55	0.0	0	0	-426,710	0	0	4,741.4	0	0	0.0	0	0
55 - 60	0.0	0	0	-465,502	0	0	5,172.4	0	0	0.0	0	0
60 - 65	0.0	0.	0	-504,293	0	0	5,603.5	0	0	0.0	0	0
65 - 70	0.0	0	0	-543,085	0	0	6,034.5	0	0	0.0	0	0
70 - 75	0.0	0	0	-581,877	0	0	6,465.6	0	0	0.0	0	0
75 - 80	0.0	0	0	-620,669	0	0	6,896.6	0	0	0.0	0	0
80 - 85	0.0	0	0	-659,461	0	0	7,327.6	0	0	0.0	0	0
85 - 90	0.0	0	0	-698,253	0	0	7,758.7	0	0	0.0	0	0
90 - 95	0.0	0	0	-737,044	0	0	8,189.7	0	0	0.0	0	0
95 - 100	0.0	0	0	-775,836	0	0	8,620.7	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,338	0.0	0	0	0.0	0	8,760

Sagisti alties (S

------ MONTHLY ENERGY CONSUMPTION -----

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	5,893	29	1,326	5
Feb	5,318	29	981	5
March	6,075	29	151	3
April	5,085	28	0	0
May	5,527	28	0	0
June	5,493	28	0	0
July	5,119	28	0	0
Aug	5,731	28	0	0
Sept	5,085	28	0	0
0ct	5,527	28	0	0
Nov	5,315	29	142	2
Dec	5,648	29	931	4
Total	65,817	29	3,532	5

Building Energy Consumption =
Source Energy Consumption =

26,055 (Btu/Sq Ft/Year) 26,547 (Btu/Sq Ft/Year) Floor Area = 22,176 (Sq Ft)

......

			U T I L I T Y	PEAK	CHEC	. K S U M S
Utility	ELECTRIC DE	MAND				
Peak Va Yearly	lue 28.7 Time of Peak	4				
Hour 9	Month 1					
Sub Tota	al				0.0	0.00
Heating	Equipment					
1	EQ2201	GAS FIRED UNIT HE	ATER		0.5	1.74
2	EQ2201	GAS_FIRED UNIT HE	ATER		0.3	1.04
Sub Tota	al				0.8	2.78
Sub Tota	al				0.0	0.00
Sub Tota	al				0.0	0.00
Miscella	aneous					
Lights					27.9	97.22
	tilities				0.0	0.00
	quipment				0.0	0.00
Sub Tota	al ·				27.9	97.22
Grand To	otal				28.7	100.00

Ε	M	C	EN	GII	NE	ERS.	INC.

Denver • Colorado Springs • Atlanta • Germany

Bldg, 1830

1.) #4 Unit Headers (24,500 BTUH TO 45,000 BTUH) = 14

2.) " (100,000 BTUH) = 1

3)# of I.R. Heaters (240,000 TO 270,000 BTUH) = 17

Replacement Cost

Means Mech. Cost Data: # 52000 Unit Heaters (1.) \$52000 X 14 = 728000 (1992) pg. 180 40 MBH (Line 2020)

(Lihe 2080) # 76500 11 11 (2.)#76500 XI =#76500

Pg. 176 # 92500 IR HEATERS (3.) # 92500 X 17 = 15,725 Line 0240

23,776 °°

		10017011 1111		_				
		LOCATION: Whi		•	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				00 - ENERGY EFFICIEN	T WINDOWS		FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/04/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IN\	/ESTMENT						
•	A.	CONSTRUCTION	COST	_			\$57,602	
	В.	SIOH COST		(5.5% of 1A) =			\$3,168	
	C.			(6.0% of 1A) =			\$3,456	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$64,227	
		SALVAGE VALUE		(i.b i i.b) =			\$0	
		TOTAL INVESTME	NT	(1D - 1E) =			 >	\$ 64,227
				(:= :- 4				401,227
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$18.37	(10)	(\$189)	15.23	(\$2,874)	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	199	\$439	19.64	\$8,627	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		188	250.6		>	\$ 5,753
				•				
3		N-ENERGY SAVIN						
	A.			C. DEMAND SAVINGS)	=		\$0	
		1 DISCOUNT FAC			(From Table A−2) =	14.68		
	_	2 DISCOUNTED S		OST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRING	ā (+/−)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. L		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c. d TOTAL		\$0		0.00	\$0	
	С		RGY DISCOUN	\$0 ITED SAVINGS (+) / COS	T()	(040 - 0544)	\$0	
		PROJECT NON-E		11 LD SAVINGS (+) / COS	· (-)	(3A2 + 3Bd4) =		\$0
		1 25% MAXIMUM		CALCULATION		(2EE v 0 22) -	#1 000	
		a IF 3D1 => 3C 1				(2F5 x 0.33) =	\$1,899	
		b IF 3D1 < 3C Th				(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T				(2:0+051)711 =		
		d F 3D1b < 1 TH	IEN PROJECT	DOES NOT QUALIFY				
4	FIR	ST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3 ·	+ 3A + (3B1d/25)) =		\$251
5	TO	TAL NET DISCOUN	TED SAVINGS			(2F5 + 3C) =		\$5,753
6	DIS	COUNTED SAVING	S-TO-INVEST	MENT RATIO (SIR)		(5/1F) =		0.09
	(IF	SIR < 1 THEN PRO	DJECT DOES N	IOT QUALIFY)				
7	SIM	IPLE PAYBACK (SP	B)			(1F/4) =		256.34

		LOCATION: Whi		-	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				102 – ENERGY EFFICIEN	TWINDOWS		FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/04/92	2	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1 1	IN۱	/ESTMENT						
	A.	CONSTRUCTION	COST	-			\$27,622	
1	В.	SIOH COST		(5.5% of 1A) =			\$1,519	
(C.	DESIGN COST		(6.0% of 1A) =			\$1,657	
1	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$30,799	
1	E.	SALVAGE VALUE		=			\$0	
ı	F.	TOTAL INVESTME	ENT	(1D - 1E) =			>	\$30,799
2 1	EN	ERGY SAVINGS (+)	ACOST ()					
ا ع	-14	FUEL TYPE	FUEL COST	SAVINGS	ARIRIETAL A	DISCOUNT	DISCOUNTED	
		. Vue IIFE	\$/MBTU (1)		ANNUAL \$		DISCOUNTED	
ı	Δ	ELEC	\$/MB1U(1) \$18.37	MBTU/YR (2)	SAVINGS (3) \$6	FACTOR (4) 15.23	\$45 \$95	
		DIST	φι ο. 3/	0	\$0	17.28	\$ 95	
		NAT GAS	\$2.21		\$95	17.28	\$0 \$1,860	
		PAPER	Ψ2.21	0	\$95 \$0	18.04	\$1,800 \$0	
		COAL		v	\$0	16.22	\$0	
_		TOTAL		43	100.9	10.22		\$1.055
•	•	TOTAL		43	100.9			\$1,955
3 1	NO	N-ENERGY SAVIN	GS (+) / COST	· (-)				
				EC. DEMAND SAVINGS)	_		\$0	
		1 DISCOUNT FAC			(From Table A-2) =	14.68	•	
		2 DISCOUNTED S	AVINGS (+) /	COST (-)	(3A x 3A1) =		\$0	
E	В.	NON-RECURRING	3 (+/–)		, ,		-	
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0	, ,	0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
C	Э.	TOTAL NON-ENE	RGY DISCOU	NTED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$0
	ο.	PROJECT NON-E	NERGY TEST					
		1 25% MAXIMUM	NON-ENERG	Y CALCULATION		(2F5 x 0.33) =	\$645	
		a IF 3D1 => 3C 7	THEN GO TO	4				
		b IF 3D1 < 3C T	HEN CALCULA	ATE SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T	HEN GO TO 4	1		•		
		d IF 3D1b < 1 Th	IEN PROJECT	T DOES NOT QUALIFY				
4 F	FIR	ST YEAR DOLLAR	SAVINGS (4)	(COSTS (-)	(959	+ 3A + (3B1d/25)) =		\$101
		TAL NET DISCOUN			(2) 3	(2F5 + 3C) =		\$1,955
				STMENT RATIO (SIR)		(2F5 ∓ 3C) = (5/1F) =		0.06
		SIR < 1 THEN PRO				(3/11)=		0.00
		IPLE PAYBACK (SP		worken 1)		(1F/4) =		305.17
		BAOK (OF	-,			(17/4) =		305.17

				-				
		LOCATION: Whit		-	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				24 - ENERGY EFFICIEN	TWINDOWS		FISCAL YEAR:	1992
		DISCRETE PORTIO		TOTAL				
		ANALYSIS DATE:	06/04/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
	1815	ECTMENT						
1		VESTMENT	COCT				****	
		CONSTRUCTION	COSI	/F F0/ -64.4\			\$102,092	
		SIOH COST DESIGN COST		(5.5% of 1A) =			\$5,615	
		ENERGY CREDIT		(6.0% of 1A) =			\$6,126	•
		SALVAGE VALUE		(1A + 1B + 1C) =			\$113,833	
		TOTAL INVESTME	:NT	(1D – 1E) =			\$0	6110.000
	٠.	TOTAL INVESTIGE		(10 - 12) =			>	\$113,833
2	EN	ERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$18.37	5	\$83	15.23	\$1,268	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	332	\$734	19.64	\$14,412	
	D.	PAPER	** ****	0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		336	817.1		>	\$15,681
3		N-ENERGY SAVIN		• •				
	A.			C. DEMAND SAVINGS)	=		\$0	
		1 DISCOUNT FAC			(From Table A-2) =	14.68		
	_	2 DISCOUNTED S		OST (-)	(3A x 3A1) ≈		\$0	
	В.	NON-RECURRING	3 (+/−)					
		ITEM			YEAR OF		DISCOUNTED	
		_		SAVINGS (1)	OCCURRENCE (2)		SAVINGS (4)	
		a. b.		\$0		0.00	\$0	
		С.		\$0		0.00	\$0	
		d TOTAL		\$0 \$0		0.00	\$0	
	C.		BGY DISCOUN	عد ITED SAVINGS (+) / COs	ST (_)	(3A2 + 3Bd4) =	\$0	**
	_	PROJECT NON-E		TED OXITITED (1), OOC	,, (-)	(SAZ + SBU4) =		\$0
		1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$ 5,175	
		a IF 3D1 => 3C T				(1.0 % 0.00) =	40,170	
		b IF 3D1 < 3C Th	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T	HEN GO TO 4			,		
		d IF 3D1b < 1 TH	IEN PROJECT	DOES NOT QUALIFY				
	_							
		RST YEAR DOLLAR			(2F3	+ 3A + (3B1d/25)) =		\$817
		TAL NET DISCOUN				(2F5 + 3C) =		\$15,681
б				MENT RATIO (SIR)		(5/1F) =		0.14
-		F SIR < 1 THEN PRO		IOT QUALIFY)				
,	211/	MPLE PAYBACK (SP	(ם)			(1F/4) =		139.31

		e Sands Missile R	J	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
Р	ROJECT TITLE:	ECO #9 - P128 -	ENERGY EFFICIEN	T WINDOWS		FISCAL YEAR:	1992
D	ISCRETE PORTK	ON NAME: TO	TAL				
A	NALYSIS DATE:	06/04/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1 INVE	STMENT						
A. C	ONSTRUCTION	COST	=			\$72,187	
B. S	OH COST		(5.5% of 1A) =		•	\$3,970	
C. D	ESIGN COST		(6.0% of 1A) =			\$4,331	
D. E	NERGY CREDIT		(1A + 1B + 1C) =			\$80,488	
E. S	ALVAGE VALUE		=			\$0	
F. T	OTAL INVESTME	NT	(1D - 1E) =			 >	\$80,488
2 ENEF	RGY SAVINGS (+)	/ COST (-)					
	UEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
		\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
A. E	LEC	\$18.37	6	\$115	15.23	\$1,757	
B. D	IST		0	\$0	17.28	\$0	
C. N	AT GAS	\$2.21	130	\$287	19.64	\$5,633	
D. P.	APER		0	\$0		\$0	
E. C	OAL			\$0	16.22	\$0	
F. T	OTAL		136	402.2		>	\$7,390
	-ENERGY SAVIN						
			EMAND SAVINGS)	=		\$0	
	DISCOUNT FAC			(From Table A-2) =	14.68		_
		AVINGS (+) / COS	T (-)	(3A x 3A1) =		\$0	
	ON-RECURRING	i (+/ -)					
1	TEM			YEAR OF	DISCOUNT	DISCOUNTED	
			SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
a.			\$0		0.00	\$0	
b.	•		\$0		0.00	\$0	
C.	TOTAL		\$0		0.00	\$0	
	TOTAL	OCY DISCOUNTE	\$0 \$0.000 (1)	NT ()	(242 - 271)	\$0	
	ROJECT NON-ENER		D SAVINGS (+) / COS	51 (-)	(3A2 + 3Bd4) =		\$0
		NON-ENERGY CA	ALCUI ATION		(055 0.00)	40.400	
	a IF 3D1 => 3C T		RECOLATION		(2F5 x 0.33) =	\$2,439	
		IEN CALCULATE :	ei D		(2F5 + 3D1) / 1F =		
	c IF3D1b ≂> 1 T		JII 1		(2F5 + 301) / 1F =		
			ES NOT QUALIFY	•			
4 FIRST	YEAR DOLLAR	SAVINGS (+) / COS	STS (-)	/0E0	± 3∆ ± (3D1 <i>d1</i> 0EW =		***
	L NET DISCOUN		J. J (-)	(2F3	+ 3A + (3B1d/25)) =		\$402
		S-TO-INVESTME	NT BATIO (SIR)		(2F5 + 3C) =		\$7,390
		JECT DOES NOT			(5/1F) =		0.09
	LE PAYBACK (SP				/1E/A) -		200 42
. 911111		-,			(1F/4) =		200.13

			•				•	
		LOCATION: Whi	te Sands Missil	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				29 – ENERGY EFFICIEN	T WINDOWS		FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/04/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IN۱	VESTMENT						
	A.	CONSTRUCTION	COST	-			\$37,866	
	В.	SIOH COST		(5.5% of 1A) =			\$2,083	
	C.	DESIGN COST		(6.0% of 1A) =			\$2,272	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$42,220	
	E.	SALVAGE VALUE		-			\$0	
	F.	TOTAL INVESTME	ENT	(1D - 1E) =			>	\$42,220
2	EN	IERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$18.37	5	\$89	15.23	\$1,350	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	69	\$152	19.64	\$2,982	
	D.	PAPER		ò	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		73	240.5		>	\$4,332
3	NC	N-ENERGY SAVIN	IGS (+) / COST	(-)				
Ī				C. DEMAND SAVINGS)	-		\$0	
		1 DISCOUNT FAC		,	(From Table A-2) =	14.68	**	
		2 DISCOUNTED		COST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRING		• •	•		• •	
		ITEM	` ,		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)		SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENE	RGY DISCOU	NTED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$0
	D.	PROJECT NON-E	NERGY TEST					
		1 _{25%} MAXIMUM	NON-ENERG	Y CALCULATION		(2F5 x 0.33) =	\$1,430	
		a IF 3D1 => 3C	THEN GO TO 4	ļ				
		b IF 3D1 < 3C T	HEN CALCULA	ATE SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1	THEN GO TO 4	•	•			
		d IF 3D1b < 1 T	HEN PROJECT	DOES NOT QUALIFY				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$ 240
		TAL NET DISCOU		• •	•	(2F5 + 3C) =		\$4,332
6	DIS	SCOUNTED SAVING	GS-TO-INVES	TMENT RATIO (SIR)		(5/1F) =	•	0.10
		F SIR < 1 THEN PR				•		
7		MPLE PAYBACK (SI		-		(1F/4) =		175.57
		•				• •		•

		•						
		LOCATION: Whi	te Sands Missi	le Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	ECO #9 - P1	43 - ENERGY EFFICIEN	T WINDOWS		FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/04/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IN	IVESTMENT						
	A.	CONSTRUCTION	COST				\$37,866	
	В.	SIOH COST		(5.5% of 1A) =			\$2,083	
	C.	DESIGN COST		(6.0% of 1A) =			\$2,272	
	D.	ENERGY CREDIT		(1A+1B+1C)=			\$42,220	
	E.	SALVAGE VALUE					\$0	
÷	F.	TOTAL INVESTME	NT	(1D - 1E) =			 >	\$42,220
2	E	NERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$18.37	5	\$89	15.23	\$1,350	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	69	\$152	19.64	\$2,982	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		73	240.5		>	\$4,332
3	NO	ON-ENERGY SAVIN	GS (+) / COST	(-)				
				C. DEMAND SAVINGS)			\$0	
		1 DISCOUNT FAC		, , , , , , , , , , , , , , , , , , , ,	(From Table A-2) =	14.68	•	
		2 DISCOUNTED S		OST (-)	(3A x 3A1) =	14.55	\$0	
	В.	NON-RECURRING		,	(Critically)		40	
		ITEM	` ,		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENE	RGY DISCOUN	ITED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =	•	\$0
		PROJECT NON-E				,		••
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$1,430	
		a IF 3D1 => 3C 1	HEN GO TO 4					
		b IF 3D1 < 3C TH	IEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =		
		c iF 3D1b => 1 T	HEN GO TO 4					
		d IF 3D1b < 1 Th	EN PROJECT	DOES NOT QUALIFY	•			
4	FI	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$240
		TAL NET DISCOUN			12.0	(2F5 + 3C) =		\$4,332
		SCOUNTED SAVING				(5/1F) =		0.10
		F SIR < 1 THEN PRO				(3.11)		0.10
7		MPLE PAYBACK (SP		,		(1F/4) =		175.57
						, ,		

			_				
	LOCATION: Wh		•	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
			D1A - ENERGY EFFICIEN	NT WINDOWS - CLEA	R GLASS	FISCAL YEAR:	1992
	DISCRETE PORT		TOTAL				
	ANALYSIS DATE:	06/11/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1 #	NVESTMENT						
	A. CONSTRUCTION	COST	=			\$39,008	
_	3. SIOH COST		(5.5% of 1A) =			\$2,145	
c	DESIGN COST		(6.0% of 1A) =			\$2,340	
	. ENERGY CREDIT		(1A + 1B + 1C) =			\$43,494	
E	. SALVAGE VALUE		=			\$0	
	. TOTAL INVESTM		(1D - 1E) =			 >	\$43,494
							¥ 1- , 12 1
2 E	ENERGY SAVINGS (4	-) / COST ()					
	FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
		\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A. ELEC	\$6.48	33	\$213	15.23	\$3,245	
E	B. DIST		0	\$0	17.28	\$0	
C	. NAT GAS	\$2.21	0	\$0	19.64	\$0	
). PAPER		0	\$0		\$0	
E	E. COAL			\$0	16.22	\$0	
F	. TOTAL		33	213.1		>	\$ 3,245
	ION-ENERGY SAVII						
A			C. DEMAND SAVINGS)	=		\$1,404	
	1 DISCOUNT FA			(From Table A-2) =	14.68		
_	2 DISCOUNTED		COST (-)	(3A x 3A1) =		\$20,611	
	B. NON-RECURRIN	G (+/-)					
	ITEM		0418100 (4)	YEAR OF	DISCOUNT	DISCOUNTED	
			SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
	a. b.		\$0		0.00	\$0	
	С.		\$0 \$0		0.00	\$0	
	d TOTAL		\$0		0.00	\$0	
c		RGY DISCOUR	ITED SAVINGS (+) / COS	T (_)	(3A2 + 3Bd4) =	\$0	600 614
	PROJECT NON-		(125 OXVIII 40 (+) 1 000	' (-)	(3A2 + 3BU4) =		\$20,611
_	1 25% MAXIMUM		Y CALCULATION		(2F5 x 0.33) =	\$1,071	
	a IF 3D1 => 3C				(21 0 X 0.00) =	\$1,071	
	b IF 3D1 < 3C T	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =	0.10	
	c IF 3D1b => 1	THEN GO TO 4			(2.0.00.),	0.10	
	d IF 3D1b < 1 T	HEN PROJECT	DOES NOT QUALIFY				
4 F	IRST YEAR DOLLAF	R SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$1,617
	OTAL NET DISCOU				(2F5 + 3C) =		\$23,856
	DISCOUNTED SAVIN				(5/1F) =		0.55
	(IF SIR < 1 THEN PR		OT QUALIFY)				
7 S	SIMPLE PAYBACK (S	PB)			(1F/4) =		26.90

	LOCATION: Whi		-	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
	PROJECT TITLE:	ECO #9 - P5	01A - ENERGY EFFICIEI	NT WINDOWS - GREY	GLASS	FISCAL YEAR:	1992
	DISCRETE PORT		TOTAL				
	ANALYSIS DATE:	06/11/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1 IN	VESTMENT						
A	CONSTRUCTION	COST	=			\$42,361	
В	. SIOH COST		(5.5% of 1A) =			\$2.330	
C	. DESIGN COST		(6.0% of 1A) =			\$2,542	
	. ENERGY CREDIT	•	(1A + 1B + 1C) =			\$47,233	
	. SALVAGE VALUE		(\$0	
	. TOTAL INVESTM		(1D - 1E) =			>	\$ 47,233
			, ,				,
2 E	NERGY SAVINGS (+) / COST (-)					
	FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
		\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
A	. ELEC	\$6.48	33	\$213	15.23	\$ 3,245	
В	. DIST		0	\$0	17.28	\$0	
С	. NAT GAS	\$2.21	0	\$0	19.64	\$0	
D	. PAPER		0	\$0		\$0	•
E	. COAL			\$0	16.22	\$0	
F.	. TOTAL		33	213.1		>	\$3,245
2 Ni	ON-ENERGY SAVIN	166 (T) (COST	(_)				
		• •	(-) C. DEMAND SAVINGS)	_		\$4.708	
^.	1 DISCOUNT FAC		O. DEMAND GAVINGS)	(From Table A-2) =	14.68	\$1,738	
	2 DISCOUNTED		OCT ()	•	14.08	6 05 477	
R	NON-RECURRIN	, -	,001 (-)	(3A x 3A1) =		\$25,477	
-	ITEM	u (₩-)		YEAR OF	DISCOUNT	DISCOUNTED	
	1120		SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
	a .		ÇAVIII 43 (1) \$0	OCCORNENCE (2)	0.00	\$0	
	b.		\$0		0.00	\$0	
	с.		\$0		0.00	\$0	
	d TOTAL		\$0	•	0.00	\$0	
c		BGY DISCOUR	TED SAVINGS (+) / COS	T (_)	(3A2 + 3Bd4) =	3 0	\$05.477
	. PROJECT NON-E		41ED 3AVII4G3 (+) / CO3	,	(SA2 + 3504) =		\$25,477
	1 25% MAXIMUM		V CALCULATION		(OFF + 0 20) -	6 1 071	
	a IF 3D1 => 3C				(2F5 x 0.33) =	\$1,071	
	b IF 3D1 < 3C T				(0EE : 2D4) (4E -	0.00	
	c IF3D1 < 3C				(2F5 + 3D1) / 1F ≖	0.09	
			DOES NOT QUALIFY				
4 FI	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$1,949
5 T	OTAL NET DISCOUN	NTED SAVINGS	3		(2F5 + 3C) ≖		\$28,722
6 D	ISCOUNTED SAVING	GS-TO-INVES	TMENT RATIO (SIR)		(5/1F) =		0.61
(IF SIR < 1 THEN PR	OJECT DOES I	NOT QUALIFY)				
7 SI	IMPLE PAYBACK (SI	PB)			(1F/4) =		24.24

							•	
		LOCATION: Whit	te Sands Missil	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	ECO #9 - P5	018 - ENERGY EFFICIEN	NT WINDOWS - CLEAR	R GLASS	FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/11/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IN۱	ESTMENT						
	A.	CONSTRUCTION	COST	=			\$27,507	
	В.	SIOH COST		(5.5% of 1A) =			\$1,513	
	C.	DESIGN COST		(6.0% of 1A) =			\$1,650	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$30,670	
	E.	SALVAGE VALUE					\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$30,670
2	ĖN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	2	\$11	15.23	\$163	-
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	67	\$149	19.64	\$2,925	
	D.	PAPER			\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		69	159.6		>	\$3,088
3	NC	N-ENERGY SAVIN	IGS (+) / COST	(-)				
				C. DEMAND SAVINGS)	=		\$39	
		1 DISCOUNT FAC			(From Table A-2) =	14.68	•	
		2 DISCOUNTED S		COST (-)	(3A x 3A1) =		\$573	
	В.	NON-RECURRING	• •	,	(,		74.0	
		ITEM	-()		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)		SAVINGS (4)	
		a.		\$0	(2)	0.00	\$0	
		b.		\$0		0.00	\$0	
		C.		\$0		0.00	\$0	
		d TOTAL		\$0		5.00	\$0	
	C.		BGY DISCOU	NTED SAVINGS (+) / COS	ST (_)	(3A2 + 3Bd4) =	4.	\$573
		PROJECT NON-E		• •	· · · /	(5/4 + 5544) 4		4013
	٥.	1 25% MAXIMUM				(2F5 x 0.33) =	\$1,019	
		a IF 3D1 => 3C				(21 5 X 0.55) =	\$1,015	
		b IF 3D1 < 3C T				(OFF : OD4) / 4F -		
		*				(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1						
		u ir 3∪10 < 1	nen PHOJECI	DOES NOT QUALIFY				
4	E1F	DOT VEAD DOLL AD	CAMINOS (-)	COSTS ()	(252	. 04 . (054 - 105)		4400
		RST YEAR DOLLAR	, ,		(2F3	(a= 10/25)) =		\$199
		TAL NET DISCOUN				(2F5 + 3C) =		\$3,661
6				TMENT RATIO (SIR)	•	(5/1F) =		0.12
_		F SIR < 1 THEN PR		NOT QUALIFY)				
7	SI	MPLE PAYBACK (SI	PB)			(1F/4) =		154.41

		LOCATION: Wh		-	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				02 – ENERGY EFFICIEN	T WINDOWS - CLEAR	GLASS	FISCAL YEAR:	1992
		DISCRETE PORT		TOTAL				
		ANALYSIS DATE:	06/09/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	INV	VESTMENT						
		CONSTRUCTION	COST	=			\$26,747	
		SIOH COST		(5.5% of 1A) =			\$1,471	
		DESIGN COST		(6.0% of 1A) =			\$1,605	
		ENERGY CREDIT	•	(1A+1B+1C) =			\$29,823	
		SALVAGE VALUE					\$0	
		TOTAL INVESTM		(1D - 1E) =			 >	\$29,823
2	EN	IERGY SAVINGS (+	·) / COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/ MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	30	\$196	15.23	\$2,988	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	0	\$0	19.64	\$0	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		30	196.2		>	\$2,988
•	NO	N ENERGY CANAL	IOD (A) LOOOT					,
3		N-ENERGY SAVIN	• •	` '			*	
	Α.	1 DISCOUNT FAC		C. DEMAND SAVINGS)	(From Toble A. 0) —	14.00	\$1,209	
		2 DISCOUNTED		OCT ()	(From Table A-2) =	14.68	447.740	
	R	NON-RECURRIN)OS1 (-)	(3A x 3A1) =		\$17,748	
	.	ITEM	u (₩-)		YEAR OF	DISCOUNT	DISCOUNTED	
		11 2101		SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)		
		a.		\$0	OCCURNENCE (2)	0.00	SAVINGS (4)	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0		0.00	\$0	
	C.		RGY DISCOUN	NTED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =	•	\$17,748
		PROJECT NON-E			- /	(5.12) 5544) 4		ψ1/,/ 110
•		1 25% MAXIMUM		Y CALCULATION		(2F5 x 0.33) =	\$986	
		a IF 3D1 => 3C				(x •) ~	4500	
		b IF 3D1 < 3C T	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =	0.13	
		c F3D1b => 1	THEN GO TO 4			· · · · · · · · · · · · · · · · · · ·		
		d IF 3D1b < 1 T	HEN PROJECT	DOES NOT QUALIFY				
		RST YEAR DOLLAR			(2F3	+ 3A + (3B1d/25)) =		\$1,405
5	TO	TAL NET DISCOU	NTED SAVINGS	3		(2F5 + 3C) =		\$20,736
6				TMENT RATIO (SIR)		(5/1F) =	•	0.70
	(IF	F SIR < 1 THEN PR	OJECT DOES N	NOT QUALIFY)				
7	SIM	MPLE PAYBACK (SI	PB)			(1F/4) =		21.22

							•	
		LOCATION: Whit	te Sands Missil	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	ECO #9 - P50	02 – ENERGY EFFICIEN	TWINDOWS - GREY	GLASS	FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/11/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
	1818	/ECTMENT						
		VESTMENT CONSTRUCTION	COST	_			\$00.04B	
			COSI	= (5.5% of 1A) =			\$29,046 \$1,598	
		SIOH COST DESIGN COST		•			, ,	
				(6.0% of 1A) =			\$1,743 \$32,386	
		ENERGY CREDIT		(1A + 1B + 1C) =			. ,	
		SALVAGE VALUE	****	4D 4D			\$0	400.000
	г.	TOTAL INVESTME	:IN I	(1D – 1E) =			>	\$32,386
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	29	\$187	15.23	\$2,850	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	0	\$0	19.64	\$0	
	D.	PAPER	•	0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		29	187.1		>	\$2,850
3	NC	N-ENERGY SAVIN	IGS (+) / COST	(-)				
	A.	ANNUAL RECURF	RING (+/-) (ELE	EC. DEMAND SAVINGS)	=		\$1,658	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	SAVINGS (+) / C	COST (-)	(3A x 3A1) =		\$24,332	
	В.	NON-RECURRING	G (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENE	RGY DISCOU	NTED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$24,332
	D.	PROJECT NON-E	NERGY TEST	•				
		1 25% MAXIMUM	NON-ENERG	Y CALCULATION		(2F5 x 0.33) =	\$940	
		a IF 3D1 => 3C	THEN GO TO	4				
		b IF 3D1 < 3C T	HEN CALCULA	ATE SIR		(2F5 + 3D1) / 1F =	0.12	•
		c IF 3D1b => 1	THEN GO TO 4	1				
		d IF 3D1b < 1 Ti	HEN PROJECT	DOES NOT QUALIFY				
4	Eir	DET VEAR DOLL AR	CAVINGE (-)	(COSTS ()	/424			A. A
		RST YEAR DOLLAR		• •	(2F3	3 + 3A + (3B1d/25)) =		\$1,845
		OTAL NET DISCOUN				(2F5 + 3C) =		\$27,182
0				STMENT RATIO (SIR)		(5/1F) =		0.84
7		F SIR < 1 THEN PR		HOT QUALIFT)		/4 F1A		47.56
′	311	MPLE PAYBACK (SI	ro)			(1F/4) =		17.56

		LOCATION: White	e Sands Missil	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				3 - ENERGY EFFICIENT	T WINDOWS		FISCAL YEAR:	1992
		DISCRETE PORTIC	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/04/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	iN۱	/ESTMENT						
	A.	CONSTRUCTION	COST	=			\$40,750	
	В.	SIOH COST		(5.5% of 1A) =			\$2,241	
	C.	DESIGN COST		(6.0% of 1A) =			\$2,445	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$45,436	
		SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D – 1E) =			>	\$ 45,43 6
2	EN	ERGY SAVINGS (+)	(COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)		SAVINGS (5)	
	A.	ELEC	\$18.37	1	\$13	15.23	\$194	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	54	\$120	19.64	\$2,358	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		55	132.7		>	\$2,550
		•						
3	NO	N-ENERGY SAVING	SS (+) / COST ((-)				
	A.			C. DEMAND SAVINGS)	=		\$0	
		1 DISCOUNT FACT			(From Table A-2) =	14.68		
	_	2 DISCOUNTED SA		OST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRING	(+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
		÷		SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. b.		\$0		0.00	\$0	
		о. С.		\$0 \$0		0.00	\$0	
		d TOTAL		\$0		0.00	\$0 \$0	
	C.		GY DISCOUN	TED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =	φυ	\$0
		PROJECT NON-EN			• ()	(072 + 0504) =		φυ
		1 25% MAXIMUM N	ON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$841	
		a IF 3D1 => 3C T	HEN GO TO 4			(2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,	40	
		b IF 3D1 < 3C TH	EN CALCULAT	TE SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 Th	HEN GO TO 4	•		,		
		d IF 3D1b < 1 TH	EN PROJECT I	DOES NOT QUALIFY				
4	FIR	ST YEAR DOLLAR S	SAVINGS (+) / (COSTS (-)	(2F3)	+ 3A + (3B1d/25)) =		\$133
		TAL NET DISCOUNT		,	(210	(2F5 + 3C) =		\$2,550
		COUNTED SAVING		MENT RATIO (SIR)		(5/1F) =		0.08
		SIR < 1 THEN PRO				(2)		0.00
7		PLE PAYBACK (SPE		•		(1F/4) =		342.47
						• •		

		LOCATION: NEW						
		LOCATION: Whit		e Hange 4 – ENERGY EFFICIEN ⁻	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		DISCRETE PORTIO		TOTAL	1 ANIMDOMA		FISCAL YEAR:	1992
		ANALYSIS DATE:	06/04/92	IOIAL	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
								A. 01012.1
1	INV	VESTMENT						
	A.	CONSTRUCTION	COST	=			\$32,969	
	В.	SIOH COST		(5.5% of 1A) =			\$1,813	
	C.	DESIGN COST		(6.0% of 1A) =			\$1,978	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$36,761	
		SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D – 1E) =			>	\$36,761
2	ΕN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$18.37	1	\$18	15.23	\$277	
	B.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	45	\$100	19.64	\$1,969	
		PAPER		0	\$0		\$0	
		COAL			\$0	16.22	\$0	
	F.	TOTAL		46	118.4		 >	\$2,246
3	NO	N-ENERGY SAVIN	GS (±) / COST (_)				
Ī			•	D. DEMAND SAVINGS)	_		\$0	
		1 DISCOUNT FAC		,	(From Table A-2) =	14.68	•	
		2 DISCOUNTED S	AVINGS (+) / CO	OST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRING	i (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c. d TOTAL		\$0		0.00	\$0	
	C.		RGY DISCOUN	\$0 TED SAVINGS (+) / COS	T (=)	(3A2 + 3Bd4) =	\$0	**
		PROJECT NON-EI		. 25 0/1/1140 (1)/ 000	• (-)	(3A2 + 38U4) =		\$0
		1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$741	
		a IF 3D1 => 3C T	HEN GO TO 4				4	
		b IF 3D1 < 3C TH	IEN CALCULAT	E SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T	HEN GO TO 4					
		d IF 3D1b < 1 TH	EN PROJECT (DOES NOT QUALIFY				
4	FIR	ST YEAR DOLLAR	SAVINGS (+) / C	COSTS (-)	/0E2	+ 3A + (3B1d/25)) =		\$ 440
		TAL NET DISCOUN			(21-3	(2F5 + 3C) =		\$118 \$2,246
		COUNTED SAVING		MENT RATIO (SIR)		(5/1F) =		0.06
		SIR < 1 THEN PRO				` ,		
7	SIM	MPLE PAYBACK (SP	В)			(1F/4) =		310.40

		CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NMC							
	CONTRACTION	9			501000						
***************************************		EMC ENGINEERS INC.			2750 SOU	ITH WADSW	ORTH BLVI	J., #C-200,	2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO	5 80227	
	CONTRACT	CONTRACT FOR (Work to be performed) ENERGY EFFICIENT WINDOWS - DOUBLE PANE CLEA	PANE CLE	AR GLASS	, ,			PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
	PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE. NE	W MEXICO
					MATERIAL COST	-cost		LABOR COSTS			
	Line	Item	ğ 5	Quantity			Manhours	Average		Other Direct	Line
	No.	(1)	Measure (2)	(3)	Unit (4)	Total (5)	Mandays (6)	Rate	Total (8)	Costs (9)	Total (10)
	-	BUILDING 100									
		WINDOW REPLACEMENT	SF	3835	12.08	46,327	0.053	35.55	7,226		\$53,552.52
		DEMOLITION	R.	3835	0.16	614	0.032	28.00	3,436		\$4,049.76
		TOTAL									\$57,602.28
D3-14	8	BUILDING 102									
4		WINDOW REPLACEMENT	R.	1839	12.08	22,215	0.053	35.55	3,465		\$25,680.07
<u> </u>		DEMOLITION	SF	1839	0.16	294	0.032	28.00	1,648		\$1,941.98
		TOTAL		,							\$27,622.06
	က	BUILDING 124									
		WINDOW REPLACEMENT	'n	6797	12.08	82,108	0.053	35.55	12,807		\$94,914.33
1		DEMOLITION	R	6797	0.16	1,088	0.032	28.00	060'9		\$7,177.63
1		TOTAL									\$102,091.96
1	4	BUILDING 128									
L		WINDOW REPLACEMENT	S.	4806	12.08	58,056	0.053	35.55	9,055		\$67,111.70
1		DEMOLITION	SF	4806	0.16	692	0.032	28.00	4,306		\$5,075.14
											\$72,186.84
		Sour as Electrical, Mechanical, & Construction Cost Data, 1992: Mar	erial orione leading	9 Seat mentage a		a backed anotherd	1901				

ne Electrical, Mechanical, & Construction Cost Data, 1992; Material prices include 25% overhead & pro

ı											
		CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NW							
٥	CONTRACTOR				ADDRESS (, ic . i. i. i.	000		00001	
		EMC ENGINEERS INC.			7/30/30(Z/30 SOUTH WADSWORTH BLVD.,	ORIN DEV	J., #C-200,	#C-ZUO, DENVER, CO 60ZZ/	0 00227	
<u> </u>	ONTRACT F	CONTRACT FOR (WORK to be performed) ENERGY EFFICIENT WINDOWS - DOUBLE PANE CL	PANE CLE	EAR GLASS	"			PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
<u> </u>	JRCHASE R	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WORK LOCATION WHITE SANDS MISSILE		RANGE, NEW MEXICO
1					MATERIAL COST	LCOST		LABOR COSTS			
	Line	Item	o ii	Quantity			Manhours	Average		Other Direct	Line
	No.	(1)	Measure (2)	ତ	(4)	Total (5)	Mandays (6)	Rate (7)	Total (8)	Costs (9)	Total (10)
	5	BUILDING 129									
		WINDOW REPLACEMENT	SF	2521	12.08	30,454	0.053	35.55	4,750		\$35,203.62
		DEMOLITION	SF	2521	0.16	403	0.032	28.00	2,259		\$2,662.18
		TOTAL									\$37,865.80
D3-	6	BUILDING 143								•	
15		WINDOW REPLACEMENT	SF	2521	12.08	30,454	0.053	35.55	4,750		\$35,203.62
1		DEMOLITION	R	2521	0.16	403	0.032	28.00	2,259		\$2,662.18
		TOTAL									\$37,865.80
 	/-	BOH DING 501									
l		WINDOW REPLACEMENT	SF	4725	12.08	57,078	0.053	35.55	6,903		\$65,980.61
		DEMOLITION	SF	4725	0.16	756	3800	28.00	4,234		\$4,989.60
		TOTAL									\$70,970.21
	8	BUILDING 502	Ì								
		WINDOW REPLACEMENT	\ R F	1900	12.08	22,952	0.053	96.55	3,580		\$26,531.89
		DEMOLITION	SF	1900	0.16	304	0.032	28.00	1,702		\$2,006.40
		TOTAL							<i>j</i>		\$28,558.29
		Source: Means Flactical Mechanical & Constitution Cost Data 1992 Mainfal Infoss Include 550, reschaed & mofile Labor rates Include reschaed & mofile	rial priose include	25% overhead &	profit- labor rate	a include overhead &	t neafte				

rce: Means Electrical, Mechanical, & Construction Cost Data, 1992; Material prices include 25% overhead & profit; labor rates include overhea

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NWC							
CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SOU	TH WADSW	ОВТН ВСУС)., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO) 80227	
CONTRACT	CONTRACT FOR (WORK to be performed) ENERGY EFFICIENT WINDOWS - DOUBLE PANE GREY GLASS	PANE GRI	EY GLASS				PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	ER		WORK LOCATION WHITE SAN	DS MISSIFE	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	cost		LABORICOSTS			
Line	Item	of E	Quantity			Manhours	Average		Other Direct	Line
Ö	Έ)	Measure (2)	ල	D (4)	Total (5)	Mandays (6)	Rate	Total (8)	Costs (9)	Total (10)
-	BUILDING 501A									
	WINDOW REPLACEMENT	SF	2771	13.29	36,827	0.053	22.24	3,266		\$40,092.82
	DEMOLITION	SF	2771	0.16	443	0.032	20.58	1,825		\$2,268.23
	TOTAL									\$42,361.05
2	BUILDING 502									
	WINDOW REPLACEMENT	SF	1900	13.29	25,251	0.053	22.24	2,240		\$27,490.57
	DEMOLITION	SF	1900	0.16	304	0.032	20.58	1,251		\$1,555.26
	TOTAL									\$29,045.83
				:						
			,							
	So Bears Electrical, Mechanical, & Construction Cost Data, 1992; Material prices include	sterial prices includ	a 25% overhead &		roe: U.S. Dent. of La	bor. General Wade	Decision No. NW91-	bor source: U.S. Dept. of Labor. General Wade Decision No. NM91-1 & Include Ovild & Profit	rofit	

D3-16

-											
	CONTRACTOR	я EMC ENGINEERS INC.			ADDRESS 2750 SOL	JTH WADSW	ORTH BLVI	J., #C-200,	2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO) 80227	
. ~	CONTRACT	CONTRACT FOR (WORK to be parlormed) ENERGY EFFICIENT WINDOWS - DOUBLE PANE CLEAR GLASS	PANE CLI	EAR GLAS	S			PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
, -	PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	IDS MISSILE	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	N MEXICO
<u> </u>					MATERIAL COST	LCOST		LABOR COSTS			
	Line	Item	Onit of	Quantity			Manhours	Average		Other Direct	Line
	o N	ε	Measure (2)	ල	Chit	Total (5)	Mandays (6)	Rate	Total	Costs	Total
1	-	BUILDING 501A									
II		WINDOW REPLACEMENT	SF	2771	12:08	33,474	0.053	22.24	3,266		\$36,739.91
		DEMOLITION	SF	2771	0.16	443	0.032	20.58	1,825		\$2,268.23
		TOTAL									\$39,008.14
D3-1	2	BUILDING 501B									
1 7		WINDOW REPLACEMENT	SF	1954	12.08	23,604	0.053	22.24	2,303		\$25,907.54
: 1		DEMOLITION	SF	1954	0.16	313	0.032	20.58	1,287		\$1,599.47
		TOTAL				·					\$27,507.01
	က	BUILDING 502									
1		WINDOW REPLACEMENT	SF	1900	12.08	22,952	0.053	22.24	2,240		\$25,191.57
I		DEMOLITION	SF	1900	0.16	304	0.032	20.58	1,251		\$1,555.26
		TOTAL									\$26,746.83
				·							
l		Source: Means Electrical, Mechanical, & Construction Cost Data, 1992; Material prices include 25% overhead & prolit; labor source: U.S. Dept. of Labor, General Wage Decision No. NM91-1 & Include Ovhd & Prolit	terial prices includ	25% overhead &	t profit; labor sou	roe: U.S. Dept. of La	bor, General Wage	Secieton No. NM91-	1 & Include Ovhd & Pr	offt	

CONSTRUCTION COST ESTIMATE BREAKDOWN

		CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NW							
8	CONTRACTOR	R EMC ENGINEERS INC.			ADDRESS 2750 SOI	JTH WADSW	ORTH BLVI	D., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	D 80227	
8	TTRACT F	CONTRACT FOR (Work to be performed) ENERGY EFFICIENT WINDOWS - DOUBLE PANE CLEAR GLASS	PANE CLE	AR GLAS	ွ			PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE	-	
Ę	CHASER	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BEH		WORK LOCATION WHITE SAN	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
L					MATERIAL COST	L cost		LABOR COSTS			
· -	Line	Tell	č Čit	Quantity			Manhours	Average		Other Direct	Line
	o N	(2)	Measure (2)	ල	G (4)	Total (5)	Mandays (6)	Rate	Total (8)	Costs	Total (10)
<u> </u>	6	BUILDING 503									
		WINDOW REPLACEMENT	SF	2713	12.08	32,773	0.053	35.55	5,112		\$37,884.74
		DEMOLITION	SF	2713	0.16	434	0.032	28.00	2,431		\$2,864.93
		TOTAL									\$40,749.67
20.10	10	BUILDING 504									
		WINDOW REPLACEMENT	SF	2195	12.08	26,516	0.053	35.55	4,136		\$30,651.31
		DEMOLITION	R	2195	0.16	351	0.032	28.00	1,967		\$2,317.92
		TOTAL									\$32,969.23
<u> </u>											
		Source: Means Electrical, Mechanical, & Construction Cost Data, 1992; Material prices include 25% overhead & profit; labor rates include overhead & profit	terial prices includ	25% overhead	& profit; labor ra	es include overhead (k profit				

ESOS STUDY AT WSMR - BUILDING 100
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: Elevation: 3,918 (ft) 25.8 (in. Hg) Barometric Pressure: Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 16:40: 2 1/22/92 Dataset Name: 100 .TM

Space heating thermostid: 76°F

mennandi

assertantions.

Opt Vent

Total

0.0

-1,273.0

System Block RAD RADIATION Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: 0 OADB: 24 Space Ret. Air Ret. Air Net Percnt Space Percnt * Coil Peak Percnt Space Peak Sens.+Lat. Sensible Total Of Tot Latent Sensible Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (%) (Btuh) (Btuh) (Btuh) (%) * (Btuh) (Btuh) (%) Skylite Solr U Λ O 0.00 0 0.00 * 0 0.00 Skylite Cond 0 ٥ 0.00 0 0.00 * 0 0 0.00 Roof Cond 0 0 0.00 0.00 * 0 -96,977 -96,977 8,96 Glass Solar 0 0 Ω 0.00 0 0.00 * 0 0 0.00 Glass Cond Ω 0 0 0.00 0 0.00 * -217,902 -217,902 20.12 -406,977 Wall Cond 0 0 0 0.00 0 0.00 * -406,977 37.59 Partition 0 0 0.00 0 0.00 * -4,042 -4,042 0.37 Exposed Floor 0 0 0.00 n 0.00 * 0 0 0.00 Infiltration O 0.00 0.00 * -356,920 -356,920 32.96 Sub Total ==> 0 -1,082,818 -1,082,818 0.00 0.00 * 100.00 Internal Loads Lights 0 0.00 * 0.00 * 0 0 0 0 0 0.00 People 0.00 * 0 0 0 0.00 * 0 O 0.00 Misc 0 0 0 0.00 * O 0.00 * 0 0 0.00 Sub Total ==> 0 0 0.00 0 0.00 * Λ n 0.00 Ceiling Load 0 0 0 0.00 n 0.00 * n Ω 0.00 Outside Air O 0.00 * 0 0 0.00 * O n 0.00 Sup. Fan Heat 0 0.00 * 0.00 * 0.00 Ret. Fan Heat n 0 0.00 * 0.00 * 0.00 Duct Heat Pkup 0.00 * 0.00 * 0.00 OV/UNDR Sizing 0.00 * 0.00 * 0 Exhaust Heat Ð O 0.00 * 0.00 0 Terminal Bypass 0 0.00 * 0 a 0.00 0.00 Grand Total ==> 0 0 0.00 * 0.00 * -1,082,818 -1,082,818 100.00 ------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR **Gross Total** Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 30,722 Main Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 22,258 Part Aux Clg 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 0 Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 15,572 0 0 Totals 0.0 0.0 Wall 22,789 3,330 15 ------HEATING COIL SELECTION----------AIRFLOWS (cfm)-------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Cooling Lva Type Heating Clg % OA 0.0 Type Clg (Mbh) (cfm) Deg F Dea F 0 n Vent Clg Cfm/Sqft 0.00 SADB 0.0 76.1 Main Htg -1,273.0 0 0.0 0.0 Infil 0 7,168 Clg Cfm/Ton 0.00 Plenum 0.0 76.0 Aux Htg 0.0 n 0.0 0.0 Supply 0 Clg Sqft/Ton 0.00 Return 0.0 76.0 Preheat 0.0 Λ 0.0 0.0 Mincfm 0 Clg Btuh/Sqft 0.00 Ret/OA 0.0 76.0 Reheat 0.0 0 0.0 0.0 Return O No. People Ω Runarnd 0.0 76.0 Humidif 0.0 0

D3-20

0

0

0

0

0

Htg % OA

Htg Cfm/SqFt

Htg Btuh/SqFt

0.0

0.00

-41.44

Fn MtrTD

Fn BldTD

Fn Frict

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

Exhaust

Rm Exh

Auxil

social and a second

Opt Vent

Total

0.0

0.0

0.0

0.0

Rm Exh

Auxil

Fn BldTD

Fn Frict

0.00

0.00

0.3

0.8

0.0

0.0

3ys telli		reak	52	- SINGLE										
			OOLING COIL		*****	*****	***	**** CLG	SPACE	PEAK ****	***** HE	EATING COIL	PEAK	*****
	at Time ==			3/16			*		Hr:	8/16 *	•	Mo/Hr:	0/0	
Outside	Air ==>	OAL	DB/WB/HR: 9	6/ 63/ 49.	O _.		*	OA	DB:	96 *	,	OADB:	0	
							*			*	•			
	_	Space		Ret. Air		t Percnt		Sp	ace	Percnt *	Space F	eak Coil	Peak	Percn
		ens.+Lat.	Sensible	Latent	Total			Sensi	ble	Of Tot *	Space S	ens Tot	Sens	Of To
Envelope		(Btuh)	(Btuh)	(Btuh)	(Btuh)			(Bt	uh)	(%) *	(Bt	tuh) (Btuh)	(%
•	te Solr	0	0			0.00			0	0.00	•	0	0	0.0
•	te Cond	0	0			0.00			0	0.00 *	•	0	0	0.0
Roof (0	0		(0	0.00 *		0	0	0.0
	Solar	14,496	0		14,496				496	29.25 *		0	0	0.0
Glass		5,990	0		5,990			•	990	12.09 *	•	0	0	0.0
Wall (19,625	0		19,625			19,		39.61 *	•	0	0	0.00
Partit		-1,945			-1,945			-1,	945	-3.93 *	•	0	0	0.00
•	ed Floor	0			(0	0.00 *	•	0	0	0.00
	tration	0	_		(0	0.00 *	•	0	0	0.00
	otal==>	38,166	0		38,166	5 70.02	*	38,	166	77.02 *	•	0	0	0.00
Internal			_				*			*				
Lights		28,409	0		28,409			28,		57.33 *		0	0	0.00
People	3	4,200	_	_	4,200			2,	300	4.64 *		0	0	0.00
Misc		0	0	0	, , , , , , , , , , , , , , , , , , ,				0	0.00 *		0	0	0.00
	otal==>	32,609	0	0	32,609			30,		61.97 *		0	0	0.00
Ceiling		0	0						0	0.00 *		0	0	0.00
Outside		0	0	0	656				0	0.00 *		0	0	0.00
Sup. Far			•		2,400					0.00 *			0	0.00
Ret. Far			0		0					0.00 *			0	0.00
OUCT Hea		-10 72/	0		40.70					0.00 *			0	0.00
Exhaust	-	-19,324	0	•	-19,324			-19,	324	-39.00 *		0	0	0.00
Terminal			0	0	0					0.00 *			0	0.00
rerminae	. Буразэ		v	U	0	0.00	*			0.00 *			0	0.00
Grand To	otal==>	51,451	0	0	54,506	100.00	*	49,	551	100.00 *		0	0	0.00
• • • • • • • • • • • • • • • • • • • •			COOL	ING COIL S	ELECTION							AREAS		
	Total (Capacity	Sens Cap.	Coil Airfl	Enteri	ng DB/WB,	/HR	Leav	ing DE	B/WB/HR	Gross To	tal Gl	ass (s	f) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	g F Gra	ins	Deg F (Deg F	Grains	Floor	3,784		
Main Clg	5.0	60.0	58.2	2,250	78.4 5	9.3 57	7.2	53.9	48.9	51.9	Part	838		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	0		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	0		0 0
Totals	5.0	60.0									Wall	2,884	:	302 10
	HEATING	G COIL SELE	CTION		AI	RFLOWS (d	cfm)-		E	NGINEERING	CHECKS	TEMPER	RATURE	S (F)
		y Coil Ai	rfl Ent	Lvg	Type	Cooling	1	leating	Clg	% OA	2.5	Type	Clg	
	(Mbh)	(cfm) Deg F	Deg F	Vent	56		0	Clg	Cfm/Sqft	0.59	SADB	55.0	_
Main Htg	-0.0	_	0.0	0.0	Infil	0		0	Clg	Cfm/Ton	450.00	Plenum	78.	
Aux Htg	0.0	0	0.0	0.0	Supply	2,250		0	Clg	Sqft/Ton	756.70	Return	78.	
Preheat	-0.0	2,2	50 0.6	53.9	Mincfm	0		0		Btuh/Sqft		Ret/OA	78.	
Reheat	0.0	۱ (0.0	0.0	Return	2,250		0		People	10	Runarnd		
Kumidif	0.0	0	0.0	0.0	Exhaust	56		0		% OA	0.0	Fn MtrTC		
Ont Vent	0.0	n	0 00	0.0	Om Ful	_								

0

0

0

Htg Cfm/SqFt

Htg Btuh/SqFt

अवस्थितिस्थानसंस्

System	3	Peak	PTAC	- PACKAGE	D TERMINAL	AIR COND.							
******	******	*****	COOLING COIL	. PEAK ****	*****	*****	***** CL	G SPACE	PEAK ****	******** HE	ATING COIL	PEAK **	**
Peaked a	at Time :	==>	Mo/Hr:	7/16					7/16	•	Mo/Hr:	0/0	
Outside	Air ==>	0	ADB/WB/HR:	97/ 64/ 49.	0			OADB:		r	OADB:	0	
							*		•	•			
		Space	Ret. Air	Ret. Air	Net	Percnt	*	Space	Percnt 1	Space P	eak Coil	Peak	Percnt
		Sens.+Lat.	Sensible	Latent	Total	Of Tot	* Sen	sible	Of Tot	Space S	ens Tot		Of Tot
Envelope	e Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	* (Btuh)	(%)	•		Stuh)	(%)
Skylit	te Solr	0	0		0	0.00	*	0	0.00	•	0	0	0.00
Skylit	te Cond	0	0	1	0	0.00	*	0	0.00	,	0	0	0.00
Roof C	Cond	8,911	0	1	8,911	8.05	*	8,911	9.20	,	0	0	0.00
Glass	Solar	5,670	0	1	5,670	5.12	*	5,670	5.85	,	0	0	0.00
Glass	Cond	4,432	0	l	4,432	4.00	*	4,432	4.57 *	,	0	0	0.00
Wall C	Cond	28,945	0		28,945	26.15		8,945	29.87 *	•	0	0	0.00
Partit	tion	0			. 0	0.00	*	. 0	0.00 *		0	0	0.00
Expose	ed Floor	0			0	0.00	*	0	0.00 *		0	0	0.00
Infili	tration	0			. 0	0.00	*	0	0.00 *	,	0	0	0.00
Sub To	otal==>	47,958	0		47,958	43.33	* 4	7,958	49.49 *		0	0	0.00
Internal	Loads	•	_				*	. , , , , ,	*	,	·	Ū	0.00
Lights	3	19,694	0		19,694	17.79	* 19	9,694	20.32 *	:	0	0	0.00
People	•	5,040			5,040	4.55	*	2,760	2.85 *	·	0	0	0.00
Misc		0	0	0	0	0.00	*	0	0.00 *		0	0	0.00
Sub To	otal==>	24,734	0	0	24,734	22.35	* 2	2,454	23.17 *		0	0	0.00
Ceiling	Load	0	0		0	0.00	*	0	0.00 *		0	0	0.00
Outside	Aîr	0	0	0	9,930	8.97	*	0	0.00 *		0	0	0.00
Sup. Fan	1 Heat				1,564	1.41	*		0,00 *			0	0.00
Ret. Fan	Heat		0		0	0.00	*		0.00 *			0	0.00
Duct Hea	t Pkup		0		0	0.00	*		0.00 *			0	0.00
OV/UNDR	Sizing	26,487			26,487	23.93	* 26	5,487	27.33 *		0	0	
Exhaust	Heat		0	0	0	0.00	*		0.00 *			0	0.00
Terminal	Bypass		0	0	0	0.00	*		0.00 *			0	0.00
							*		*				
Grand To	tal==>	99,180	0	0	110,674	100.00	* 96	5,900	100.00 *		0	0	0.00
			coo	LING COIL SE	LECTION						AREAS-	*****	
	Total	Capacity	Sens Cap.	Coil Airfl	Enterin	g DB/WB/I	HR Lea	eving D	B/WB/HR	Gross To	tal Gla	ss (sf)	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F Deg	F Grain	ns Deg F	Deg F	Grains	Floor	2,623		
Main Clg	11.0	132.0	130.9	4,400	80.8 59	.0 52.	.0 54.8	47.1	43.5	Part	0		
Aux Clg	0.0	0.0	0.0	0	0.0	.0 0.	0.0	0.0	0.0	ExFlr	0		
Opt Vent	0.0	0.0	0.0	0	0.0	.0 0.	0.0	0.0	0.0	Roof	1,958	(0 0
Totals	11.0	132.0								Wall	2,736	203	3 7
	HEATI	NG COIL SEL	ECTION		AIR	FLOWS (c1	fm)	1	ENGINEERING	CHECKS	TEMPER	ATURES ((F)
	Capaci	ty Coil A	irfl Ent	Lvg	Type	Cooling	Heating		g % OA	13.9	Туре	Clg	Htg
	(Mbh) (cf	m) Deg F	Deg F	Vent	612	C	CL	g Cfm/Sqft	1.68	SADB	55.0	0.0
Main Htg	-0	.0	0.0	0.0	Infil	0	0	Cl	g Cfm/Ton	400.00	Plenum	78.0	0.0
Aux Htg	0	.0	0.0	0.0	Supply	4,400	0		g Sqft/Ton	238.45	Return	78.0	0.0
Preheat	-0	.0 4,	400 3.3	54.6	Mincfm	0	٥		g Btuh/Sqft		Ret/OA	80.7	0.0
Reheat	0	.0	0.0	0.0	Return	4,400	0	No.	. People	12	Runarnd	78.0	0.0
Humidif	0	.0	0.0	0.0	Exhaust	612	0		g % OA	0.0	Fn MtrTD		0.0
						0,2	·	, uri	g As OA	0.0	III MELID	0.1	
Opt Vent		.0	0.0		Rm Exh	0	0		g Cfm/SqFt	0.00	Fn BldTD	0.1 0.1	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE - BUILDING 100

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------ BUILDING U-VALUES-----

					Roc	om U-Val	ues				Room	Room
					(Btu	ı/hr/sqt	t/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	BLDG 100 1ST FLR	0.388	0.000	0.000	0.000	0.000	1.140	1.259	0.402	0.000	55.3	11,06
2	BLDG 100 2ND FLR	0.388	0.000	0.000	0.000	0.120	1.140	1.259	0.402	0.000	111.1	23.12
Zone	<pre>1 Total/Ave.</pre>	0.388	0.000	0.000	0.000	0.120	1.140	1.259	0.402	0.000	86.5	17.81
3	BSMT & 1ST FL SZ	0.301	0.000	0.000	0.000	0.000	1.140	1.259	0.402	0.000	55.7	11.15
Zone	2 Total/Ave.	0.301	0.000	0.000	0.000	0.000	1.140	1.259	0.402	0.000	55.7	11.15
4	1 & 2 FLR - PTAC	0.000	0.000	0.000	0.000	0.120	1.140	1.259	0.402	0.000	106.4	21.95
Zone	3 Total/Ave.	0.000	0.000	0.000	0.000	0.120	1.140	1.259	0.402	0.000	106.4	21.95
System	1 Total/Ave.	0.385	0.000	0.000	0.000	0.120	1.140	1.259	0.402	0.000	84.4	17.34
3	BSMT & 1ST FL SZ	0.301	0.000	0.000	0.000	0.000	1.140	1.259	0.402	0.000	55.7	11.15
Zone	2 Total/Ave.	0.301	0.000	0.000	0.000	0.000	1.140	1.259	0.402	0.000	55.7	11.15
System	2 Total/Ave.	0.301	0.000	0.000	0.000	0.000	1.140	1.259	0.402	0.000	55.7	11.15
4	1 & 2 FLR - PTAC	0.000	0.000	0.000	0.000	0.120	1.140	1.259	0.402	0.000	106.4	21.95
Zone	3 Total/Ave.	0.000	0.000	0.000	0.000	0.120	1.140	1.259	0.402	0.000	106.4	21.95
System	3 Total/Ave.	0.000	0.000	0.000	0.000	0.120	1.140	1.259	0.402	0.000	106.4	21.95
Buildin	g ,	0.382	0.000	0.000	0.000	0.120	1.140	1.259	-	0.000	83.1	17.04

BUILDING AREAS - ALTERNATIVE 1
BASELINE - BUILDING 100

				Floor	Total		Exposed						
		Numb	er of	Area/Dupl	Floor	Partition	Floor	Skylight	Skl	Net Roof	Window	Win	Net Wall
Room		Dupi	icate	Room	Area	Area	Area	Area	/Rf	Area	Area	/WL	Area
Number	Description -	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	BLDG 100 1ST FLR	1	1	10,702	10,702	10,710	0	0	0	0	1,275	19	5,572
2	BLDG 100 2ND FLR	1	1	13,614	13,614	10,710	0	0	0	13,614	1,550	15	8,772
Zone	1 Total/Ave.				(24,316	21,420	0	0	0	13,614	2,825	16	14,343
3	BSMT & 1ST FL SZ	1	1	3,784	3,784	838	0	0	0	0	302	10	2,582
Zone	2 Total/Ave.				3,784	838	0	0	0	0	302	10	2,582
4	1 & 2 FLR - PTAC	1	1	2,623	2,623	0	0	0	0	1,958	203	7	2,534
Zone.	3 Total/Ave.				2,623	0	0	0	0	1,958	203	7	2,534
System	1 Total/Ave.				30,722	22,258	0	0	0	15,572	3,330	15	19,459
3	BSMT & 1ST FL SZ	1	1	3,784	3,784	838	0	0	0	0	302	10	2,582
Zone	2 Total/Ave.				3,784	838	0	0	0	0	302	10	2,582
System	2 Total/Ave.				3,784	838	0	0	0	0	302	10	2,582
4	1 & 2 FLR - PTAC	1	1	2,623	2,623	0	0	0	0	1,958	203	7	2,534
Zone	3 Total/Ave.				2,623	0	0	0	0	1,958	203	7	2,534
System,	3 Total/Ave.				2,623	0	0	0	0	1,958	203	7	2,534
Buildin	g				37,128	23,096	0	0	0	17,530	3,835	13	24,574

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System Totals

Percent	Cool	ing Loa	ad	Heati	ng Load		Cooling	Airflow		Heating	Airflo	,
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.8	11	378	-63,650	12	459	332.5	0	0	0.0	0	0
5 - 10	1.6	11	364	-127,300	9	326	665.0	0	0	0.0	0	0
10 - 15	2.4	9	291	-190,950	9	334	997.5	0	0	0.0	0	0
15 - 20	3.2	8	287	-254,600	12	439	1,330.0	0	0	0.0	0	0
20 - 25	4.0	7	247	-318,250	13	469	1,662.5	0	0	0.0	0	0
25 - 30	4.8	8	282	-381,900	11	420	1,995.0	0	0	0.0	0	0
30 - 35	5.6	7	242	-445,550	14	518	2,327.5	1	49	0.0	0	0
35 - 40	6.4	8	287	-509,200	8	304	2,660.0	0	0	0.0	0	0
40 - 45	7.2	8	262	-572,850	6	240	2,992.5	0	0	0.0	0	0
45 - 50	8.0	9	291	-636,500	6	208	3,325.0	0	0	0.0	0	0
50 - 55	8.8	4	150	-700,150	0	10	3,657.5	0	0	0.0	0	0
55 - 60	9.6	3	108	-763,800	0	0 -	3,990.0	0	0	0.0	0	0
60 - 65	10.4	4	151	-827,450	0	0	4,322.5	0	0	0.0	0	0
65 - 70	11.2	2	63	-891,100	0	0	4,655.0	12	436	0.0	0	0
70 - 75	12.0	0	0	-954,750	0	0	4,987.5	0	0	0.0	0	0
75 - 80	12.8	0	0	-1,018,400	0	0	5,320.0	0	0	0.0	0	0
80 - 85	13.6	0	0	-1,082,050	0	0	5,652.5	0	0	0.0	0	0
85 - 90	14.4	0	0	-1,145,700	0	0	5,985.0	0	0	0.0	0	0
90 - 95	15.2	0	0	-1,209,350	0	0	6,317.5	0	0	0.0	0	0
95 - 100	16.0	0	0	-1,273,000	0	0	6,650.0	86	3,079	0.0	0	0
Hours Off	0.0	0	5,357	0	0	5,033	0.0	0	5,196	0.0	0	8,760

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------ MONTHLY ENERGY CONSUMPTION -------

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	19,290	87	4,680	13
Feb	17,443	87	3,811	13
March	20,477	87	2,163	8
April	17,744	112	291	5
May	29,045	143	0	0
June	37,700	146	0	0
July	39,990	146	0	0
Aug	39,532	146	0	0
Sept	28,311	141	0	0
0ct	20,985	138	85	3
Nov	17,973	87	2,087	9
Dec	18,694	87	3,722	11
Total	307,184	146	16,839	13

Building Energy Consumption = Source Energy Consumption =

88,938 (Btu/Sq Ft/Year) 90,633 (Btu/Sq Ft/Year) Floor Area =

30,722 (Sq Ft)

annamanni

TRACE 600 ANALYSIS ********

ESOS STUDY AT WSMR - BUILDING 100 WHITE SANDS MISSILE RANGE NM US ARMY EMC ENGINEERS, INC.

EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (CLEAR) ECO#9

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) 25.8 (in. Hg) Barometric Pressure: Summer Clearness Number: 1.00 1.00

Winter Clearness Number: Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

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Air Density: 0.0653 (Lbm/cuft) Air Specific Heat: 0.2444 (Btu/lbm/F) Density-Specific Heat Prod:

0.9575 (Btu-min./hr/cuft/F) Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft) Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 13:23:13 1/27/92

Dataset Name: 100 .TM

D3-27

SADB

Ptenum

Return

Ret/OA

Runarnd

Fn MtrTD

Fn BldTD

Fn Frict

0.00

0.00

0.00

0

0.0

0.00

-41.44

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

76.1

76.0

76.0

76.0

76.0

0.0

0.0

0.0

Block RAD - RADIATION System Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: 0 OADR: 24 Space Ret. Air Ret. Air Net Percnt * Space Percnt * Space Peak Coil Peak Percnt Sens.+Lat. Sensible Latent Total Of Tot Sensible Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr n Ω n 0.00 n 0.00 * n 0.00 0 Skylite Cond O n Ω 0.00 0 0.00 * n 0 0.00 Roof Cond 0 0 0 0.00 0 0.00 * -96,977 -96,977 11.15 0.00 0.00 * Glass Solar 0 0 0 0 0.00 0 0 0 0.00 0 0.00 * -55,125 6.34 Glass Cond -55,125 0.00 * Wall Cond 0 n 0 0.00 0 -406,977 -406,977-46.78 Partition 0 0 0.00 0 0.00 -4,042 -4,042 0.46 Exposed Floor 0.00 0.00 0 0 0 0 0 0.00 0 0 0.00 0 0.00 -306,951 -306,951 Infiltration-35.28 Sub Total ==> 0 0 0.00 0 0.00 * -870,073 -870,073 100.00 Internal Loads Lights 0 0.00 0 0.00 0 0 0.00 0.00 * People 0 0 0 0.00 0 0 0.00 Misc 0 0 0 0.00 * 0 0.00 0 0 0.00 Sub Total ==> 0 0 0 0 0.00 * 0 0.00 0 0 0.00 Ceiling Load 0 0 0.00 * 0 0.00 0 0 0.00 Outside Air 0.00 * 0 0.00 0 0.00 Sup. Fan Heat 0 0.00 * 0.00 0 0.00 Ret. Fan Heat 0 0 0.00 * 0.00 0 0.00 0.00 * 0.00 * Duct Heat Pkup Ω n 0 0-00OV/UNDR Sizing 0 0.00 * 0.00 * Exhaust Heat 0.00 0.00 * 0 Terminal Bypass 0.00 * 0.00 0 0 0.00 Grand Total ==> 0 0 0.00 * 0.00 * -870,073 -870,073 100.00 ------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/KR Leaving DB/WB/HR Glass (sf) (%) Gross Total (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 30,722 Main Clg 0.0 0.0 0.0 ۵ 0.0 0.0 22,258 0.0 0.0 0.0 0.0 Part Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Exflr 0 Opt Vent 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 15.572 0 0 Totals 0.0 0.0 Wall 22,789 3,330 15 -------HEATING COIL SELECTION----------AIRFLOWS (cfm)------- ENGINEERING CHECKS----TEMPERATURES (F)---Cooling Capacity Coil Airfl Ent Lvg Type Heating Clg % OA 0.0 Type Clg Htg (Mbh) (cfm) Deg F Deg F Vent 0 0 Clg Cfm/Sqft 0.00

Main Htg

Aux Htg

Preheat

Reheat

Humidif

Total

Opt Vent

-1,273.0

0.0

0.0

0.0

0.0

0.0

-1,273.0

0

O

0

n

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

Infil

Supply

Mincfm

Return

Exhaust

Rm Exh

Auxil

0

Ω

n

0

Ω

0

Λ

6,165

Λ

0

0

0

n

Clg Cfm/Ton

Clg Sqft/Ton

Clg Btuh/Sqft

Htg Cfm/SqFt

Htg Btuh/SqFt

No. People

Htg % OA

78.0

78.3

78.0

0.4

0.3

8.0

0.0

0.0

0.0

0.0

0.0

0.0

Return

Ret/OA

Runarnd

Fn MtrTD

Fn BldTD

Fn Frict

System Peak SZ - SINGLE ZONE

Peaked at	t Time ==	:>	Mo/Hr:	8/16			* Mo/	Hr: 8,	/16 *	•	Mo/Hr:	0/0	
Outside A	Air ==>	QA	DB/WB/HR:	96/ 63/ 49.1	0		-	DB: 90		,	OADB:	0	
							*			i			
		Space	Ret. Air	Ret. Air	Net	Percnt	* Sp	ace	Percnt *	Space Peal	Coil	Peak	Percn
	s	ens.+Lat.	Sensible	Latent	Total	Of Tot	* Sensi	ble	Of Tot *	Space Sens	Tot	Sens	Of To
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	* (Bt	uh)	(%) *	(Btuh)) (B	tuh)	(%
Skylite	e Solr	0	0		0	0.00	*	0	0.00 *	' ()	0	0.0
Skylite	e Cond	0	0		0	0.00	*	0	0.00 *	. ()	0	0.0
Roof Co	ond	0	0		0	0.00	*	0	0.00 *	' ()	0	0.0
Glass S	Solar	15,100	0		15,100	27.79	* 15,	100	30.47 *)	0	0.0
Glass (Cond	1,629	0		1,629	3.00	* 1,	629	3.29 *	, ()	0	0.0
Wall Co	ond	19,625	0		19,625	36.12	* 19,	625	39.61 *	, ()	0-	0.0
Partiti	ion	-1,945			-1,945	-3.58	* -1.·		-3.93 *		3	0	0.0
Exposer	d Floor	. 0			0		*	0	0.00 *)	0	0.0
Infilti		0			0		*	0	0.00 *	_		o	0.0
Sub Tot	tal==>	34,408	0		34,408	63.33	* 34,	408	69.44 *			0	0.0
Internal	Loads	•			•		*		*	•	•	•	•••
Lights		28,409	0		28,409	52.29	* 28,	409	57.33 *		1	0	0.0
People		4,200			4,200		•	300	4.64 *			0	0.0
Misc		. 0	0	0	0		*	0	0.00 *			0	0.0
Sub Tot	tal==>	32,609	0	0	32,609		* 30,	709	61.97 *			0	0.0
Ceiling L	Load	. 0	0		0		*	0	0.00 *			0	0.0
Outside A	Air	0	0	0	483		*	0	0.00 *	_		0	0.0
Sup. Fan	Heat				2,400	4.42	*		0.00 *			0	0.0
Ret. Fan	Heat		0		. 0	0.00	*		0.00 *			0	0.0
Duct Heat	t Pkup		0		0	0.00	*,		0.00 *			0	0.0
OV/UNDR S	Sizing	-15,566			-15,566	-28.65	* -15,1	566	-31.42 *		}	0	0.0
Exhaust H	Heat	·	0	0	o	0.00	*		0.00 *			0	0.0
Terminal	Bypass		0	0	0	0.00	*		0.00 *			0	0.0
	•••				_		*		*			·	0.0
Grand Tot	tal==>	51,451	0	0	54,334	100.00	* 49,	551	100.00 *	·	1	0	0.0
		•••••	cooi	ING COIL SI	ELECTION		•••••	•••••			AREAS-		
	Total	Capacity	Sens Cap.	Coil Airfl	Enterir	ng DB/WB/H	IR Leav	ing DB/	WB/HR	Gross Total	Gla	ss (sf)	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F Deg	F Grain	ns Deg F I	Deg F	Grains	Floor 3	,784		
ain Clg	5.0	60.0	58.1	2,250	78.3 59).3 57.	5 53.9	48.9	52.0	Part	838		
ux Clg	0.0	0.0	0.0	0	0.0	0.0 0.	0.0	0.0	0.0	ExFlr	0		
pt Vent	0.0	0.0	0.0	0	0.0	0.0 0.	0.0	0.0	0.0	Roof	0		0
otals	5.0	60.0								Wall 2	,884	30	2 1
	HEATIN	G COIL SEL	ECTION		AIR	RFLOWS (cf	m)	EN	IGINEERING	CHECKS	TEMPER	ATURES	(F)
	Capacit	y Coil A	irfl Ent	Ĺvg	Type	Cooling	Heating	Clg	% OA	1.8	Туре	Clg	Htg
	(Mbh)	(cf	m) Deg F	Deg F	Vent	. 41	0	Clg	Cfm/Sqft	0.59	SADB	55.0	0.
		0	0 0.0						•				

Aux Htg

Preheat

Reheat

Humidif

Opt Vent

Total

0.0

-0.0

0.0

0.0

0.0

0.0

0

0

0

0

2,250

0.0

0.4

0.0

0.0

0.0

0.0

53.9

0.0

0.0

0.0

Supply

Mincfm

Return

Exhaust

Rm Exh

Auxil

0

41

0

0

2,250

2,250

0

0

0

0

0

Clg Sqft/Ton

Clg Btuh/Sqft

Htg Cfm/SqFt

Htg Btuh/SqFt

No. People

Htg % OA

756.70

15.86

10

0.0

0.00

0.00

definitions.

Total

0.0

3 Peak PTAC System - PACKAGED TERMINAL AIR COND. Peaked at Time ==> Mo/Hr: 7/16 Mo/Hr: 7/16 Mo/Hr: 0/ 0 Outside Air ==> OADB/WB/HR: 97/64/49.0 OADB: 97 OADB: 0 Space Ret. Air Ret. Air Net Percnt Percnt * Space Peak Coil Peak Space Sens.+Lat. Sensible Latent Total Of Tot Sensible Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (Btuh) (%) (Btuh) (%) Skylite Solr 0 0 0 0.00 0.00 * 0 0 0 0.00 Skylite Cond 0 0.00 * 0 0.00 * 0.00 0 0 0 0 Roof Cond 8,911 0 8,911 8.11 8,911 9.20 * 0 0.00 0 Glass Solar 0 5,872 5,872 5.35 5,872 6.06 0 0 0.00 Glass Cond 1,205 0 1,205 1.10 * 1,205 1.24 * 0 0 0.00 Wall Cond 28,945 0 26.35 * 28,945 28,945 29.87 0 0-0.00 0 Partition 0 0.00 * 0 0.00 0 0.00 Exposed Floor 0 0 0.00 * 0 0.00 0 0 0.00 Infiltration 0 n 0.00 * 0.00 n 0 0 0.00 Sub Total ==> 44,934 0 44,934 40.90 44,934 46.37 0 0 0.00 Internal Loads Lights 19,694 O 19,694 17.93 19,694 20.32 O n 0.00 People 5.040 5,040 4.59 2.85 2,760 0 Ω 0.00 0.00 * Misc n Λ Λ O 0 0.00 ٥ 0.00 Sub Total==> 24,734 0 0 24,734 22.52 * 22,454 23.17 0 0.00 Ceiling Load 0 0 0 0.00 0.00 a 0.00 Outside Air 9,112 8.29 0.00 0 Ω 0.00 Sup. Fan Heat 1.564 1.42 0.00 0 0.00 Ret. Fan Heat n 0 0.00 0.00 * 0 0.00 Duct Heat Pkup 0 - 0 0.00 0.00 0.00 OV/UNDR Sizing 29,511 29,511 26.86 30.46 29,511 0 Exhaust Heat 0 0 0.00 0.00 0 Terminal Bypass 0 0 0.00 0.00 n 0.00 Grand Total ==> 99,180 0 0 109,856 100.00 * 96,900 100.00 * 0.00 -----COOLING COIL SELECTION----------ARFAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Gross Total Leaving DB/WB/HR Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 2,623 Main Clg 11.0 132.0 131.0 4,400 80.7 59.0 52.4 54.8 47.1 43.6 Part 0 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 0 Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 1,958 Roof 0 0 Totals 11.0 132.0 Wall 2,736 203 7 ------HEATING COIL SELECTION---------- AIRFLOWS (cfm)--------TEMPERATURES (F)----- ENGINEERING CHECKS--Capacity Coil Airfl Ent Type Cooling Clg % OA Lvg Heating 12.9 Type Clg (Mbh) (cfm) 569 Deg F Deg F Vent 0 Clg Cfm/Sqft 1.68 SADB 55.0 0.0 Main Htg -0.0 Ð 0.0 0.0 Infil 0 0 Clg Cfm/Ton 400.00 Plenum 78.0 0.0 Aux Htg 0.0 0 0.0 0.0 4,400 Supply 0 Clg Sqft/Ton 238.45 Return 78.0 0.0 Preheat -0.0 4,400 3.1 54.6 Mincfm 0 0 Clg Btuh/Sqft 50.33 80.5 Ret/OA 0.0 Reheat 0.0 0 0.0 0.0 4,400 0 Return No. People 12 Runarnd 78.0 0.0 Humidif 0.0 0 0.0 0.0 569 0 Exhaust Htg % OA 0.0 Fn MtrTD 0.1 0.0 Opt Vent 0.0 0 0.0 0.0 Rm Exh 0 0 Htg Cfm/SqFt 0.00 Fn BldTD 0.1 0.0

D3-30

Auxil

0

Htg Btuh/SqFt

0.00

En Frict

0.2

0.0

System Totals

Percent	Cool	ing Lo	ad	Heati	ng Load		Cooling	Airflo	w	Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours		Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.8	12	427	-63,650	16	566	332.5	0	0	0.0	0	0
5 - 10	1.6	11	378	-127,300	9	339	665.0	0	0	0.0	0	0
10 - 15	2.4	10	358	-190,950	11	386	997.5	0	0	0.0	0	0
15 - 20	3.2	8	283	-254,600	12	428	1,330.0	0	0	0.0	0	0
20 - 25	4.0	8	290	-318,250	11	391	1,662.5	0	0	0.0	0	0
25 - 30	4.8	8	286	-381,900	14	512	1,995.0	0	0	0.0	0	0
30 - 35	5.6	9	313	-445,550	11	400	2,327.5	2	71	0.0	0	0
35 - 40	6.4	10	350	-509,200	9	333	2,660.0	0	0	0.0	0	0
40 - 45	7.2	8	302	-572,850	6	227	2,992.5	0	8	0.0	0	0
45 - 50	8.0	5	182	-636,500	1	41	3,325.0	0	0	0.0	0	0
50 - 55	8.8	4	146	-700,150	0	0	3,657.5	0	0	0.0	0	0
55 - 60	9.6	4	130	-763,800	0	0	3,990.0	0	0	0.0	0	0
60 - 65	10.4	3	109	-827,450	0	0	4,322.5	0	0	0.0	0	0
65 - 70	11.2	1	40	-891,100	0	0	4,655.0	10	347	0.0	0	0
70 - 75	12.0	0	0	-954,750	0	0	4,987.5	0	0	0.0	0	ō
75 - 80	12.8	0	0	-1,018,400	0	0	5,320.0	0	0	0.0	0	Ō
80 - 85	13.6	0	0	-1,082,050	0	0	5,652.5	0	0	0.0	0	0
85 - 90	14.4	0	0	-1,145,700	0	0	5,985.0	0	0	0.0	0	0
90 - 95	15.2	0	0	-1,209,350	0	0	6,317.5	0	0	0.0	0	0
95 - 100	16.0	0	0	-1,273,000	0	0	6,650.0	89	3,225	-0.0	0	0
Hours Off	0.0	0	5,166	0	0	5,137	0.0	0	5,117	0.0	0	8.760

------ MONTHLY ENERGY CONSUMPTION ------

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(k₩h)	(kW)	(Therm)	(Thrm/hr)
Jan	19,290	87	4,269	11
Feb	17,443	87	3,451	10
March	20,380	87	1,688	7
April	17,861	112	208	4
May	29,101	142	0	0
June	38,368	146	0	0
July	39,639	146	0	0
Aug	40,216	146	0	0
Sept	29,453	141	0	0
Oct	21,281	139	45	2
Nov	18,469	87	1,809	7
Dec	18,693	87	3,384	9
Total	310,194	146	14,854	11

Building Energy Consumption =
Source Energy Consumption =

82,811 (Btu/Sq Ft/Year) 84,306 (Btu/Sq Ft/Year) Floor Area = 30,722 (Sq Ft)

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TRACE 600
          ANALYSIS
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ESOS STUDY AT WSMR - BUILDING 100 WHITE SANDS MISSILE RANGE NM US ARMY

EMC ENGINEERS, INC.

solution this

EFFICIENT WINDOWS: ALT 1-BSLN, ALTZ-ECO (GREY), ECO #9

Weather File Code: ELPASO.W Location: 31.0 (deg) Latitude: Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) 24 (F) Winter Design Dry Bulb: 0.20 Summer Ground Relectance: Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft) Air Specific Heat: 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft) Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 16: 4:13 1/27/92

Dataset Name: 100 .TM संवेदन्यक्ति । संवेदन्यक्ति

System	1	Block	RAD	- RADIAT	ION									
*****	*****	******	COOLING COI	L PEAK ****	*****	****	****	***** CL	.G SPAC	E PEAK ****	******	HEATING CO	IL PEAK	***
	at Time :		Mo/Hr:	0/ 0						0/0	*		: 13/ 1	
Outside	Air ==>	O	ADB/WB/HR:	0/ 0/ 0	.0			*	OADB:	0	*		: 24	
		_						*		,	*			
		Space	Ret. Ai			Net I	Percnt	*	Space	Percnt 1	* Space	Peak Co	il Peak	Perc
		Sens.+Lat.	Sensible					* Sen	sible	Of Tot	* Space	Sens To	ot Sens	of T
Envelope		(Btuh)	(Btuh		(8	tuh)	(%)		Btuh)	(%)	* (8	3tuh)	(Btuh)	(
-	te Solr	0		0		0	0.00	*	0	0.00	*	0	0	0.
•	te Cond	0		0		0	0.00	*	0	0.00	*	0	0	0.
Roof (0		0		0	0.00	*	0	0.00		,977 -	-96,977	11.
Glass	Solar	0		0		0		*	0	0.00		0	0	0.0
Wall (0		0		0		*	0	0.00 1		=	-56,103	6.4
Parti		0	'	0		0		*	0	0.00	,,,,	-	106,977.	46.7
		0				0	0.00		0	0.00			-4,042	0.4
•	ed Floor	0				0	0.00	*	0	0.00		0	0	0.0
	tration	0				0	0.00		0	0.00		•	306,951	35.2
Internal	tal==> Loads	0	(0		0	0.00	*	0	0.00	* -871 •	,051 -8	371,051	100.0
Lights	\$	0	()		0	0.00	*	0	0.00	•	0	0	0.0
People	•	0				0	0.00	*	0	0.00		0	0	0.0
Misc		0	(0		0		*	0	0.00 *		0	0	0.0
Sub To	tal==>	0	(0		0		*	0	0.00		0	0	0.0
Ceiling	Load	0	C)		0	0.00	*	0	0.00 *		0	0	0.0
Outside	Air	0	C	0		0	0.00	*	0	0.00 *		0	0	0.0
Sup. Fan	Heat					0	0.00	*		0.00 *	•		0	0.0
Ret. Fan	Heat		C)		0	0.00	*		0.00 *	•		0	0.0
Duct Hea	it Pkup		C)		0	0.00	*		0.00 *	•		0	0.0
OV/UNDR	Sizing	0				0	0.00	*	0	0.00 *	,	0	0	4
Exhaust			O	0		0	0.00	*		0.00 *	•		0	
Terminal	Bypass		O	0		0	0.00	*		0.00 *			0	0.0
Grand To	tal==>	0	0	0		0	0.00	*	0	0.00 *	-871	,051 -8	71,051	100.0
			coo			!	•••••			•		AREA	s	
		Capacity		Coil Airfl			DB/WB/H		_	B/WB/HR	Gross To	otal G	lass (sf) (%)
-::	(Tons)		(Mbh)	(cfm)	Deg F	_	Grain		Deg F	Grains	Floor	30,722		
ain Clg	0.0		0.0	0	0.0	0.0	_		0.0		Part	22,258		
ux Clg	0.0		0.0	0	0.0	0.0			0.0		Exflr	0		
ot Vent	0.0		0.0	0	0.0	0.0	0.	0.0	0.0	0.0	Roof	15,572		0
otals	0.0	0.0						•			Wall	22,789	3,3	30 1
••••••		NG COIL SELI				-AIRFL	OWS (cfi	m)		ENGINEERING	CHECKS	TEMPI	ERATURES	(F)
	Capaci	· -		Lvg	Туре	Co	oling	Heating	CL	% OA	0.0	Type	Clg	Htg
-i- u	(Mbh)	•	_		Vent		0	0		g Cfm/Sqft	0.00	SADB	0.0	76.
in Htg	-1,273		0 0.0		Infil		0	6,165	Cl	Cfm/Ton	0.00	Plenum	0.0	76.
ıx Htg		.0	0 0.0		Supply		0	0		g Sqft/Ton	0.00	Return	0.0	76.
reheat	0.		0 0.0		Mincfm		0	0		Btuh/Sqft	0.00	Ret/OA	0.0	76.
eheat		.0	0 0.0		Return		0	0		. People	0	Runarno	0.0	76.0
umidif	0.		0 0.0		Exhaust		0	0	Ht	3 % OA	0.0	Fn MtrT	rD 0.0	0.0
ot Vent	0.		0 0.0	0.0	Rm Exh		0	0	-	; Cfm/SqFt	0.00	Fn BldT	rD 0.0	0.0
tal	-1,273.	.0			Auxil		n	n	U+.	Dtub/CaEt	-/1 //	F		

Htg Btuh/SqFt -41.44 Fn Frict 0.0

0.0

Auxil

diadae biblica

System 2 Peak SZ - SINGLE ZONE

******	*****	****** C	OOLING COI	L PEAK ****	*****	*****	****	**** CLG	SPACE	PEAK ****	****** HE	ATING COIL	PEAK **	*****
Peaked at	t Time ==	:>	Mo/Hr:	8/16			*	Mo.	/Hr: 8	3/16 *	•	Mo/Hr:	0/0	
Outside /	Air ==>	OA	DB/WB/HR:	96/ 63/ 49.	0		*	0	ADB: 9	96 *	•	OADB:	0	
		Space	Ret. Ai	r Ret. Air	Net	Percnt	*	Si	pace	Percnt *	Space P	eak Coit	Peak	Percnt
	\$	Sens.+Lat.	Sensible		Total			Sens		Of Tot *	•		Sens	Of Tot
Envelope		(Btuh)	(Btuh		(Btuh)				tuh)	(%) *	•		Stuh)	(%)
Skylite		. 0		0	(=			,-	0	0.00 *	-	0	0	0.00
Skylite		0	(0	(0.00			0	0.00 *		0	0	0.00
Roof Co	ond	0		D	(0	0.00 *		0	0	0.00
Glass S	Solar	9,664		0	9,664			9	,664	19.50 *		0	0	0.00
Glass (1,667	•	0	1,667				,667	3.37 *		0	0	0.00
Wall Co	ond	19,625	(0	19,625				,625	39.61 *		0	0_	0.00
Partit		-1,945			-1,949				,945	-3.93 *		0	0	0.00
	d Floor	0			.,,.			• 1	0	0.00 *		0	0	0.00
Infilt		0			(0	0.00 *		0	ō	0.00
Sub Tot		29,011	4	0	29,011			20	,011	58.55 *		0	0	0.00
Internal		2,,	,	•	27,01	33.40	*	۷,	,011	*		U	Ü	0.00
Lights		28,409	()	28,409	52.29	*	28	,409	57.33 *		0	0	0.00
People		4,200	,	-	4,200				,300	4.64 *		0	0	0.00
Misc		0	(0	4,200			٠.	,500	0.00 *		0	0	0.00
Sub Tot	tal==>	32,609) 0	32,609			30	,709	61.97 *		0	0	0.00
Ceiling t		0)	JE,507			3 0,	,,	0.00 *		0	0	0.00
Outside /		0		0	477				0	0.00 *		0	0	0.00
Sup. Fan		•	,		2,400				٠	0.00 *		Ū	0	0.00
Ret. Fan			1)	2,10					0.00 *			0	0.00
Duct Heat				,)	ì					0.00 *			0	0.00
OV/UNDR S	•	-10,169	•		-10,169			-10	, 169	-20.52 *		0	0	0.00
Exhaust H	_	,		0	.0,.0			10,	, 10,	0.00 *		Ū	0	0.00
Terminal			Ì	_						0.00 *			0	0.00
	-,,				`	. 0.00	*			*			Ü	0.00
Grand Tot	tal==>	51,451	(0	54,327	100.00	*	49	,551	100.00 *		0	0	0.00
	• • • • • • • • • • • • • • • • • • • •		co	DLING COIL S	ELECTION							AREAS		
	Total	Capacity	Sens Cap.	Coil Airfl	Enteri	ng DB/WB,	/HR	Leav	ving DB	/WB/HR	Gross To	tal Gla	ass (sf)	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	g F Gra	ins	Deg F	Deg F	Grains	Floor	3,784		
Main Clg	5.0	60.0	58.1	2,250	78.3	9.4 5	7.7	53.9	49.0	52.2	Part	838		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Exflr	0		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	0		0 0
Totals	5.0	60.0									Wali	2,884	30	2 10
	HEATIN	G COIL SEL	ECTION		A	RFLOWS (cfm)-		E	NGINEERING	CHECKS	TEMPER	RATURES	(F)
	Capacit	y Coil A	irfl Ent	Lvg	Type	Cooling	Н	leating		% OA	1.8	Туре	Clg	Htg
	(Mbh)	(cfi	n) Deg I	Deg F	Vent	41		0	_	Cfm/Sqft	0.59	SADB	55.0	0.0
Main Htg	-0.	0	0.0	0.0	Infil	0		0		Cfm/Ton	450.00	Plenum	78.0	0.0
Aux Htg	0.	0	0 0.0	0.0	Supply	2,250		0		Sqft/Ton	756.70	Return	78.0	0.0
Preheat	-0.	0 2,	250 0.4	53.9	Mincfm	. 0		0	_	Btuh/Sqft		Ret/OA	78.3	0.0
Reheat	0.	0	0.0	0.0	Return	2,250		0	-	People	10		78.0	0.0
Humidif	0.	0	0.0	0.0	Exhaust	41		0		% OA	0.0	Fn MtrTC		0.0
Opt Vent	0.	0	0 0.0	0.0	Rm Exh	0		. 0	_	Cfm/SqFt	0.00	Fn BldT		0.0
Total	0.	0			Auxil	0		0	-	Btuh/SqFt		Fn Frict		0.0

Peak

System

PTAC

- PACKAGED TERMINAL AIR COND.

Mo/Hr: 0/ 0 Peaked at Time ==> Mo/Hr: 7/16 Mo/Hr: 7/16 Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 OADB: 97 OADB: 0 Percnt * Net Percnt * Coil Peak Space Ret. Air Ret. Air Space Space Peak Percnt Of Tot * Of Tot * Of Tot Sens.+Lat. Sensible Latent Total Sensible Space Sens Tot Sens Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) * (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr 0 0 0 0.00 0 0.00 0 0 0.00 Skylite Cond 0.00 Ω 0 0 0.00 0 0 ٥ 0.00 8,911 Roof Cond 8.911 0 8,911 8.11 * 9.20 0 0 0.00 3,645 Λ 3,645 3.32 * 3,645 3.76 * n n 0.00Glass Solar 1.27 * Glass Cond 1,227 n 1,227 1.12 * 1,227 n U 0.00 28,945 0 28,945 26.35 * 28,945 29.87 n 0.00 Wall Cond 0 Partition 0 0 0.00 * 0 0.00 n Ω 0.00 0.00 0.00 n Ω Exposed Floor 0 0 0 0.00 Infiltration 0 0 0.00 0 0.00 0 0 0.00 Sub Total ==> 42,728 0 42,728 38.89 42,728 44.09 0 0.00 Internal Loads 19,694 17.93 * 19,694 Lights 19,694 20.32 * n 0.00 n 0 2.85 People 5,040 5,040 4.59 * 2,760 O 0 0.00 0 0 0.00 * 0.00 0 0.00 Misc 0 0 Sub Total==> 24,734 0 0 24,734 22.52 * 22,454 23.17 ٥ 0.00 0.00 * 0.00 Ceiling Load 0 0 0 0 0 0 0.00 8.29 * Outside Air n n 9,112 0.00 O 0 0.00 n 0.00 Sup. Fan Heat 1,564 1.42 0 0.00 Ret. Fan Heat 0 0.00 0.00 0 0.00 0 Duct Heat Pkup 0 0.00 0.00 0 0_00 OV/UNDR Sizing 31,718 31,718 28.87 31,718 32.73 0 0 0.00 0.00 0 Exhaust Heat 0 ٥ 0.00 Terminal Bypass n n n 0.00 n 0.00 Grand Total ==> 99,180 0 109,856 100.00 * 96,900 100.00 * 0.00 -----COOLING COIL SELECTION-----------ARFAS-----Gross Total Glass (sf) (%) Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Deg F Deg F Grains (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains 2,623 Floor Main Clg 11.0 132.0 131.0 4,400 59.0 0 80.7 52.4 54.8 47.1 43.6 Part Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 0 Opt Vent 0.0 0.0 0.0 0 0.0 1,958 0.0 0.0 0.0 0.0 0.0 0 0 Roof 11.0 Totals 132.0 Wall 2,736 203 7 -----HEATING COIL SELECTION----------AIRFLOWS (cfm)-------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Cooling **Heating** Clg % OA Lvg Type 12.9 Type Cla Hta (Mbh) Clg Cfm/Sqft (cfm) 569 0 Deg F Deg F Vent 1.68 SADB 55.0 0.0 Main Htg -0.0 0 0.0 0.0 0 Infil 0 Clg Cfm/Ton 400.00 Plenum 78.0 0.0 Aux Htg 0.0 0 0.0 0.0 Supply 4,400 0 Clg Sqft/Ton 238.45 Return 78.0 0.0 Preheat -0.0 4,400 0 3.1 54.6 Mincfm 0 Clg Btuh/Sqft 50.33 Ret/OA 80.5 0.0 Reheat 0.0 0 0.0 0.0 4,400 0 No. People 12 Runarnd Return 78.0 0.0 Humidif 0.0 0 0.0 0.0 569 0 Exhaust Htg % OA 0.0 Fn MtrTD 0.1 0.0 Opt Vent 0.0 0 0.0 0.0 Rm Exh 0 0 Htg Cfm/SqFt 0.00 Fn BldTD 0.1 0.0

મહાલામાં મહાલા

Total

0.0

0

Htg Btuh/SqFt

0.00

Fn Frict

0.2

0.0

Auxil

System Totals

Percent	Coo	ling Loa	d	Heati	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	8.0	13	450	-63,650	13	494	332.5	0	0	0.0	0	0
5 - 10	1.6	10	363	-127,300	10	371	665.0	0	0	0.0	0	0
10 - 15	2.4	10	363	-190,950	10	358	997.5	0	0	0.0	0	0
15 - 20	3.2	9	305	-254,600	14	502	1,330.0	0	0	0.0	0	0
20 - 25	4.0	7	251	-318,250	10	371	1,662.5	0	0	0.0	0	0
25 - 30	4.8	10	341	-381,900	14	530	1,995.0	0	0	0.0	0	0
30 - 35	5.6	7	256	-445,550	12	438	2,327.5	2	76	0.0	0	0
35 - 40	6.4	9	336	-509,200	9	344	2,660.0	0	0	0.0	0	0
40 - 45	7.2	10	343	-572,850	6	207	2,992.5	0	0	0.0	0	0
45 - 50	8.0	5	175	-636,500	2	70	3,325.0	0	0	0.0	0	0
50 - 55	8.8	4	147	-700,150	0	0	3,657.5	0	0	0.0	0	0
55 - 60	9.6	3	108	-763,800	0	0	3,990.0	0	0	0.0	0	0
60 - 65	10.4	2	86	-827,450	0	0	4,322.5	0	0	0.0	0	0
65 - 70	11.2	1	20	-891,100	0	0	4,655.0	9	318	0.0	0	0
70 - 75	12.0	0	0	-954,750	0	0	4,987.5	0	0	0.0	0	0
75 - 80	12.8	0	0	-1,018,400	0	0	5,320.0	0	0	0.0	0	0
80 - 85	13.6	0	0	-1,082,050	0	0	5,652.5	0	0	0.0	0	0
85 - 90	14.4	0	0	-1,145,700	0	0	5,985.0	0	0	0.0	0	0
90 - 95	15.2	0	0	-1,209,350	0	0	6,317.5	0	0	0.0	0	0
95 - 100	16.0	0	0	-1,273,000	0	0	6,650.0	89	3,191	0.0	0	0
Hours Of		0	5,216	0	0	5,075	0.0	0	5,175	0.0	0	8,760
			•	-	_	. ,	2.0	•	- /	3.0	U	5,.55

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MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	19,290	87	4,343	11
Feb	17,443	87	3,529	10
March	20,475	87	1,862	7
April	17,698	112	263	4
May	28,724	142	0	0
June	37,991	146	0	0
July	39,229	146	0	0
Aug	39,830	146	0	0
Sept	28,877	141	0	0
0ct	21,270	138	71	2
Nov	18,470	87	1,926	7
Dec	18,694	87	3,458	9
Total	307,991	146	15,451	11

Building Energy Consumption = Source Energy Consumption =

84,509 (Btu/Sq Ft/Year) 86,065 (Btu/Sq Ft/Year)

Floor Area =

30,722 (Sq Ft)

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ESOS STUDY AT WSMR - BUILDING 102
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO ECO # 9

Weather File Code:	ELPASO	u.w
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	•
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	
Latent Heat Factor:	4,214.8	

3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Enthalpy Factor:

Time/Date Program was Run: 14:50:22 1/22/92 Dataset Name: 102 .TM Block

RAD

- RADIATION

1

System

diagriffication is

Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB: OADB: 24 OADB/WB/HR: 0/ 0/ 0.0 Percnt * Space Ret. Air Ret. Air Net Percnt * Space Space Peak Coil Peak Percnt Sensible Total Of Tot * Sensible Of Tot * Space Sens Tot Sens Sens.+Lat. Latent Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr 0.00 0 0 0 0 0.00 0 0 0.00 0.00 * Skylite Cond 0 0.00 0 0 0 0 0 0.00 0.00 * Roof Cond 0 0 0 0.00 0 -56,792 -56,792 12.76 Glass Solar 0 0 0 0.00 0 0.00 0 0 0.00 Glass Cond 0 0 0 0.00 0 0.00 -101,879 -101,879 22.89 Wall Cond 0 0 0.00 0 0.00 * -139,347 -139,347 31.31 0.00 0.00 * Partition 0 0 0 0 0 0.00 Exposed Floor 0 0.00 0.00 * -15,361 -15,361 3.45 Infiltration 0 0 0.00 0 0.00 -131,670 -131,670 29.59 0.00 0.00 * -445,049 -445,049 Sub Total ==> 0 0 0 0 100.00 Internal Loads Lights 0 0 0 0.00 0 0.00 0 0 0.00 People 0 ٥ 0.00 ٥ 0.00 n n 0.00 Misc Ω n n 0.00 0 0.00 n Ω 0 0.00 Sub Total==> 0 O n n 0.00 0 0.00 * n 0 0.00 Ceiling Load 0 0 0.00 0.00 0 Outside Air 0.00 0.00 0.00 Sup. Fan Heat 0.00 0.00 0 0.00 0.00 Ret. Fan Heat ٥ Ð 0.00 n 0.00 0.00 0.00 * Duct Heat Pkup n 0 0 0.00OV/UNDR Sizing 0 0 0.00 0.00 0 0 Exhaust Heat 0.00 0.00 0 0 Terminal Bypass 0.00 0.00 ٥ 0.00 0 0 0.00 * 0.00 * -445,049 Grand Total ==> ٥ -445,049 100.00 -----COOLING COIL SELECTION-----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR **Gross Total** Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 20.327 Main Cla 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Part 12,765 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 465 Opt Vent 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 10,163 0 Roof 0 Totals 0.0 0.0 1,839 14,020 ⊌all 13 ------HEATING COIL SELECTION----------AIRFLOWS (cfm)-------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Lvg Type Cooling Heating Clg % OA 0.0 Clg Type Hta (Mbh) (cfm) Deg F Deg F 0 Clg Cfm/Sqft Vent 0.00 SADB 0.0 68.1 Main Htg -482.5 0 0.0 0.0 Infil 0 Clg Cfm/Ton 3,125 0.00 Plenum 0.0 68.0 Aux Htg 0.0 0 0.0 0.0 Supply 0 0 Clg Sqft/Ton 0.00 Return 0.0 68.0 Preheat 0.0 0 0.0 0.0 Mincfm 0 0 Clg Btuh/Sqft 0.00 Ret/OA 0.0 68.0 Reheat 0.0 0 0.0 0.0 Return 0 No. People 0 Runarnd 0.0 68.0 Humidif 0.0 0.0 0.0 Exhaust 0 0 Htg % OA 0.0 0.0 Fn MtrTD 0.0 Opt Vent 0.0 0.0 0.0 Rm Exh 0 0 Htg Cfm/SqFt 0.00 Fn BldTD 0.0 0.0 Total -482.5 Auxil 0 Htg Btuh/SqFt -23.74 Fn Frict 0.0

*****	*****	***** C	OOLING COIL	PEAK ****	*****	*****	****** CL	.G SPAC	E PEAK ****	******** HE	ATING COIL	PEAK *	*****
Peaked a	t Time =	=>	Mo/Hr:	7/16			* 1	fo/Hr:	8/16	•	Mo/Hr:	0/0	
Outside .	Air ==>	OA.	DB/WB/HR:	97/64/49.	0		*	OADB:	96	•	OADB:	0	
							*		•	•			
		Space	Ret. Air	Ret. Air	Net	Percnt	*	Space	Percnt *	Space P	eak Coil	Peak	Percnt
	;	Sens.+Lat.	Sensible	Latent	Total	Of Tot	* Ser	sible	Of Tot	Space S	ens Tot	Sens	Of Tot
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	* ((Btuh)	(%) *	•		tuh)	(%)
Skylit	e Solr	0	0		0	0.00	*	0	0.00	-	0	0	0.00
Skylit	e Cond	0	0		0	0.00	*	0	0.00		0	0	0.00
Roof C	ond	4,691	0		4,691	16.54	*	4,222	16.33		0	0	0.00
Glass	Solar	2,927	0		2,927			3,057	11.83		0	0	0.00
Glass	Cond	1,424	0		1,424	5.02		1,290	4.99 *		0	0	0.00
Wall Co	ond	8,918	0		8,918	31.45		9,492	36.73 *		0	0	0.00
Partit		0	-		0	0.00		0	0.00		0	-	
	d Floor	0			0	0.00		0	0.00		0	0	0.00
Infilt		Ō			0	0.00		_			=	0	0.00
Sub To		17,960	0		17,960	63.34		0	0.00 *		0	0	0.00
Internal		11,700	·		17,900	03.34	*	8,061	69.88 *		0	0	0.00
Lights		6,635	0		6,635	23.40	*	6,635	25.67 *	•	0	0	0.00
People		2,100			2,100	7.41		1,150	4.45 *		0	0	
Misc		0	0	0	0	0.00		0	0.00 *		0	0	0.00
Sub Tot	tal==>	8,735	0	0	8,735	30.81		7,785	30.12 *		0	_	0.00
Ceiling t		0	0	ŭ	0,135	0.00		0				0	0.00
Outside /		0	0	0	1,305	4.60		0	0.00 *		0	0	0.00
Sup. Fan		•	·	v	356	1.25		U	0.00 *		0	0	0.00
Ret. Fan			0		0				0.00 *			0	0.00
Duct Heat			0		-	0.00			0.00 *			0	0.00
OV/UNDR S	•	0	ŭ		0	0.00		_	0.00 *		_	0	0.00
Exhaust H	-	U	0	•	0	0.00	# _	0	0.00 *		0	0	0.00
Terminal			0	0	0	0.00	-		0.00 *	'		0	0.00
TCT MITTIES	oypass		U	0	0	0.00	<u>.</u>		0.00 *	'		0	0.00
Grand Tot	:al==>	26,694	0	0	28 355	100.00	- * 2	5,846	100.00 *		0	•	0.00
			·	, ,	20,333	100.00	2	J,040	100.00		U	0	0.00
			cool	ING COIL S	ELECTION				••••••		AREAS-		
	Total	Capacity	Sens Cap.	Coil Airfl	Enterir	ng DB/WB/H	R Le	aving [OB/WB/HR	Gross To	tal Gla	ss (sf) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F Deg	F Grain			F Grains	Floor	972		
Main Clg	2.5	30.0	29.1	1,000	79.7 58	3.5 51.	4 50.8	46.4	4 47.3	Part	540		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0 0.	0 0.0	0.0	0.0	Exflr	0		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0 0.				Roof	972		a 0
Totals	2.5	30.0								Wall	1,068		55 6
											• • • • • • • • • • • • • • • • • • • •		
		G COIL SELE			AIR	-	m)	• •	-ENGINEERING	CHECKS	TEMPER	ATURES	(F)
	Capacit	-		Lvg	Туре	Cooling	Heating	CI	lg % OA	7.8	Type	Clg	Нtg
	(Mbh)		_	Deg F	Vent	78		0 C1	l g C fm/Şqft	1.03	SADB	51.0	0.0
Main Htg	-0.		0.0	0.0	Infil	0	(0 CI	lg Cfm/Ton	400.00	Plenum	78.0	0.0
Aux Htg	0.		0.0	0.0	Supply	1,000	1	0 CI	g Sqft/Ton	388.80	Return	78.0	0.0
Preheat	-0.	-	000 1.9	50.6	Mincfm	0	(o ci	lg Btuh/Sqft	30.86	Ret/OA	79.5	0.0
Reheat	0.		0.0	0.0	Return	1,000		O No	. People	5	Runarnd	78.0	0.0
Humidif	0.	0	0.0	0.0	Exhaust	78	(0 Ht	g % OA	0.0	Fn MtrTD	0.1	0.0
Opt Vent	0.	0	0.0	0.0	Dan Cul	_							
•		~	0.0	0.0	Rm Exh	0	ı	O Ht	g Cfm/SqFt	0.00	Fn BldTD	0.1	0.0

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

ROOM PSYCHROMETRICS - ALTERNATIVE 1
BASELINE BUILDING 102

------PSYCHROMETRIC STATE POINTS-----

Room 3

	Dry	Wet	Relat.	Humid.		Temp.
	Bulb	Bulb	Humid.	Ratio	Enthalpy	Diff.
	(F)	(F)	(%)	(GR)	(Btu/Lb)	(F)
Space	78.0	58.0	31.1	51.6	26.8	
Main System						
Return Air Heat Pickup						0.0
Return fan						0.0
Return Air	78.0	58.0	31.1	51.6	26.8	
Outdoor Air	97.3	63.7	16.0	49.0	31.1	
Return/Outdoor Air Mix	79.5	58.4	29.5	51.4	27.1	
Blow through Fan						0.2
Entering Coil	79.7	58.5	29.3	51.4	27.2	
Leaving Coil	50.8	47.3	79.0	50.6	20.0	
Draw Through Fan						0.0
Duct Frictional Heat						0.2
Supply Duct Heat Gain						0.0
Cold Deck Supply Air	51.0	47.4	78.4	50.6	20.1	
Supply Air	51.0	47.4	78.4	50.6	20.1	

Percent Outside Air 7.78 (%)
Sensible Heat Ratio (SHR) 0.965
Percent Supply Air Bypassing Coil 0.00 (%)
Coil Airflow 1,000 (Cfm)

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 102

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					Roc	m U-Val	ues				Room	Room
					(Btu	ı/hr/sqf	t/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.260	0.000	40.9	8.18
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.127	1.140	1.259	0.260	0.000	85.7	18.04
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.127	1.140	1.259	0.260	0.000	62.2	12.86
3	2ND FLR COOLING	0.388	0.000	0.000	0.000	0.127	1.140	1.259	0.260	0.000	101.3	21.15
Zone	2 Total/Ave.	0.388	0.000	0.000	0.000	0.127	1.140	1.259	0.260	0.000	101.3	21.15
System	<pre>1 Total/Ave.</pre>	0.388	0.750	0.000	0.000	0.127	1.140	1.259	0.260	0.000	64.0	13.26
3	2ND FLR COOLING	0.388	0.000	0.000	0.000	0.127	1.140	1.259	0.260	0.000	101.3	21.15
Zone	2 Total/Ave.	0.388	0.000	0.000	0.000	0.127	1.140	1.259	0.260	0.000	101.3	21.15
System	2 Total/Ave.	0.388	0.000	0.000	0.000	0.127	1.140	1.259	0.260	0.000	101.3	21.15
Buildin	g	0.388	0.750	0.000	0.000	0.127	1.140	1.259	0.260	0.000	65.7	13.62

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 102

------ BUILDING AREAS------

Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
				•		-	·	,			,		•
1	1ST FLOOR	1	1	10,164	10,164	8,001	465	0	0	0	890	12	6,301
2	2ND FLOOR	1	1	9,191	9,191	4,224	0	0	0	9,191	884	15	4,876
Zone	1 Total/Ave.				19,355	12,225	465	0	0	9,191	1,774	14	11,178
3	2ND FLR COOLING	1	1	972	972	540	0	0	0	972	65	6	1,003
Zone	2 Total/Ave.				972	540	0	0	0	972	65	6	1,003
System	1 Total/Ave.				20,327	12,765	465	0	0	10,163	1,839	13	12,181
3	2ND FLR COOLING	1	1	972	972	540	0	0	0	972	65	6	1,003
Zone	2 Total/Ave.				972	540	0	0	0	972	65	6	1,003
System	2 Total/Ave.				972	540	0	0	0	972	65	6	1,003
Buildin	g				21,299	13,305	465	0	0	11,135	1,904	13	13,184

System Totals

Percent	Cool	ing Loa	ad	Keati	ng Load		Cooling	Airflow	****	Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.1	8	235	-24,125	13	240	50.0	0	0	0.0	0	0
5 - 10	0.3	7	202	-48,250	16	286	100.0	0	0	0.0	0	0
10 - 15	0.4	8	256	-72,375	13	238	150.0	0	0	0.0	0	0_
15 - 20	0.5	6	191	-96,500	13	229	200.0	0	0	0.0	0	0
20 - 25	0.6	6	185	-120,625	6	114	250.0	0	0	0.0	0	0
25 - 30	0.8	6	179	-144,750	6	113	300.0	0	0	0.0	0	0
30 - 35	0.9	4	121	-168,875	6	113	350.0	0	0	0.0	0	0
35 - 40	1.0	8	257	-193,000	11	200	400.0	0	0	0.0	0	0
40 - 45	1.1	8	261	-217,125	8	146	450.0	0	0	0.0	0	0
45 - 50	1.3	6	183	-241,250	6	111	500.0	0	0	0.0	0	0
50 - 55	1.4	9	276	-265,375	1	10	550.0	0	0	0.0	0	0
55 - 60	1.5	5	144	-289,500	0	0	600.0	0	0	0.0	0	0
60 - 65	1.6	8	262	-313,625	0	0	650.0	0	0	0.0	0	0
65 - 70	1.8	4	139	-337,750	0	0	700.0	0	0	0.0	0	0
70 - 75	1.9	3	108	-361,875	0	0	750.0	0	0	0.0	0	0
75 - 80	2.0	2	48	-386,000	0	0	800.0	0	0	0.0	0	0
80 - 85	2.1	1	43	-410,125	0	0	850.0	0	0	0.0	0	0
85 - 90	2.3	0	0	-434,250	0	0	900.0	0	0	0.0	0	0
90 - 95	2.4	0	0	-458,375	0	0	950.0	0	0	0.0	0	0
95 - 100	2.5	0	0	-482,500	0	0	1,000.0	100	3,159	0.0	0	.0
Hours Off	0.0	0	5,670	0	0	6,960	0.0	0	5,601	0.0	0	8,760

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	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	8,375	43	1,133	5
Feb	7,510	43	735	5
March	8,763	43	63	3
April	7,901	43	0	0
May	9,224	47	0	0
June	9,712	47	0	0
July	9,445	47	0	0
Aug	10,270	47	0	0
Sept	8,619	47	0	0
0ct	8,670	47	0	0
Nov	7,823	43	151	2
Dec	8,014	43	773	4
	104,326	47	2,855	5

ESOS STUDY AT WSMR - BUILDING 102
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO
CLEAR

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) 25.8 (in. Hg) Barometric Pressure: Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 2:41:45 1/24/92
Dataset Name: 102 .TM

System	1	Block	RAD	- RADIAT	ION									_
*****	*****	*****	COOLING COIL	- PEAK ****	*****	*****	*****	****** CL(SPACE	PEAK ****	****** H	EATING COI	L PEAK	****
Peaked a	at Time :	==>	Mo/Hr:	0/ 0				* Mc	/Hr:	0/0	k .	Mo/Hr:	13/ 1	
Outside	Air ==>	0	ADB/WB/HR:	0/ 0/ 0	.0			* (DADB:	0 -	•	OADB:	24	
								*		•	t			
		Space	Ret. Air	Ret. Air		Net F	ercnt	* 9	pace	Percnt '	Space	Peak Coi	l Peak	Percnt
		Sens.+Lat.	Sensible	e Latent	T	otal C	of Tot	* Sens	ible	Of Tot '	* Space	Sens To	t Sens	Of Tot
Envelope		(Btuh)	(Btuh)	(Btuh)	(B	tuh)	(%)	* (E	(tuh	(%)	' (В	tuh)	(Btuh)	(%)
	te Solr	0	C)		0	0.00	*	0	0.00	•	0	0	0.00
	te Cond	0	C)		0	0.00	*	. 0	0.00	•	0	0	0.00
Roof (0	_			0	0.00	*	0	0.00	-56	,792 -	56,792	15.79
	Solar	0	C			0	0.00	*	0	0.00	7	0	0	0.00
Glass		0	C			0	0.00	*	0	0.00	-25		25,766	7.16
Wall (0	O			0	0.00	*	0	0.00	-139	,347 -1	39,347	38.74
Partit		0				0	0.00	*	0	0.00	r	0	0	0.00
•	ed Floor	0				0	0.00	*	0	0.00	-15	,361 -	15,361	4.27
	tration	0				0	0.00	*	0	0.00	-122	,453 -1	22,453	34.04
Sub To	otal==>	0	0)		0	0.00	*	0	0.00	-359	,719 -3	59,719	100.00
Internal	Loads							*			•			
Lights	5	0	0	1		0	0.00	*	0	0.00	•	0	0	0.00
People	2	0				0	0.00	*	0	0.00	•	0	0	0.00
Misc		0	0	0		0	0.00	*	0	0.00 *	•	0	0	0.00
	otal==>	0	0	0		0	0.00	*	0	0.00 *	•	0	0	0.00
Ceiling		0	0			0	0.00	*	0	0.00 *		0	0	0.00
Outside		0	0	0		0	0.00	*	0	0.00 *	•	0	0	0.00
Sup. Fan						0	0.00	*		0.00 *	•		0	0.00
Ret. Fan			0			0	0.00	*		0.00 *	,		0	0.00
Duct Hea	•	_	. 0			0	0.00	*		0.00 *	•		0	0.00
OV/UNDR	-	0				0	0.00	*	0	0.00 *	•	0	0	Q
Exhaust			.0	_		0	0.00	*		0.00 *			0	0.00
Terminal	Bypass		0	0		0	0.00	*		0.00 *			0	0.00
Grand To	tal==>	0	0	0		0	0.00	*	0	0.00 *	-359,	719 -35	59,719	100.00
			C00	LING COIL S	ELECTION							AREAS		
	Total	Capacity	Sens Cap.	Coil Airfl			DB/WB/H	R Lea	ving Di	B/WB/HR	Gross To		ass (sf	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F		Grain		-	Grains	Floor	20,327		, (,
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.		0.0	0.0	Part	12,765		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.	0.0	0.0	0.0	Exflr	465		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.	0.0	0.0	0.0	Roof	10,163		0 0
Totals	0.0	0.0									Wall	14,020	1,8	
	HEATI	NG COIL SEL	ECTION			-AIRFLO	DWS (cfi	n)	E	ENGINEERING	CHECKS	TEMPE	RATURES	(F)
	Capaci	ty Coil A	irfl Ent	Lvg	Type	Cod	oling	Heating	Cle	% OA	0.0	Туре	Clg	Htg
	(Mbh) (cf	m) Deg F	Deg F	Vent		0	0	Clg	Cfm/Sqft	0.00	SADB	0.0	_
Main Htg	-482	.5	0 0.0	0.0	Infil		0	2,907		Cfm/Ton	0.00	Plenum	0.0	
Aux Htg	0	.0	0.0	0.0	Supply		0	0		Sqft/Ton	0.00	Return	0.0	
Preheat		.0	0.0	0.0	Mincfm		0	0		Btuh/Sqft	0.00	Ret/OA	0.0	
Reheat	0.	.0	0.0	0.0	Return		0	0	No.	People	0	Runarnd		
Humidif		.0	0 0.0	0.0	Exhaust		0	0	- Htg	% OA	0.0	Fn MtrT		
Opt Vent		.0	0.0	0.0	Rm Exh		0	0	Htg	Cfm/SqFt	0.00	Fn BldT		
Total	-482.	.5			Auxil		0	0	Htg	Btuh/SqFt	-23.74	Fn Fric		

Opt Vent

Total

0.0

0.0

0.0

0.0

Rm Exh

Auxil

System	2	Peak	PTAC	-	PACKAGED	TERMINAL AIR CON	D.
--------	---	------	------	---	----------	------------------	----

Peaked at			Mo/Hr:				*	Mo	/Hr:	8/16	*	Mo/Hr:	0/0	
Outside A	ir ==>	OA	DB/WB/HR:	97/ 64/ 49.	0		*	C	ADB:	96	*	OADB:	0	
		Space	Ret. Ai	Ret. Air	Na	et Percn	- *	•	pace	Percnt	* Space F	Park Cail	Peak	Perci
	Se	ns.+Lat.	Sensible		Tota				ible	Of Tot	•		Sens	Of T
Envelope		(Btuh)	(Btuh)		(Btul				tuh)	(%)	•		Btuh)	01 1
Skylite		0	(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	0 0.0		``	0	0.00	\-	0	0	0.
Skylite		0	(*		0	0.00		0	0	0.
Roof Co	nd	4,691	(4,69			4	,222	16.86		0	0	0.
Glass \$		3,057	()	3,05				,187	12.73		0	0	0.
Glass C	ond	385	()	-	35 1.4°			351	1.40		0	0	0.
Wall Co	nd	8,918	()	8,91			G	,492	37.91		0	0	0.
Partiti	on	0			-,-	0 0.00		•	0	0.00		0	0	0.
Exposed		0				0 0.00			0	0.00		0	0	0.
Infiltr		0				0 0.00			0	0.00		0	0	0.
Sub Tot	al==>	17,051	()	17,05			17	,252	68.91		0	0	0.
Internal					,		*	••	,			· ·	Ū	٠.
Lights		6,635	()	6,63	35 24.24	. *	6	,635	26.50	+	0	0	0.
People		2,100			2,10				,150	4.59		0	0	0.
Misc		. 0	(0	-,	0 0.00		•	0	0.00		0	0	0.
Sub Tot	al==>	8,735	Ċ		8,73			7	7.785	31.09		0	0	0.
Ceiling L	oad	0	Č	_	-,	0 0.00		•	0	0.00		0	0	0.
Outside A	ir	0	(0	1,22				0	0.00		0	0	0.
Sup. Fan	Heat				35				Ť	0.00		·	0	0.
Ret. Fan I	Heat		C			0 0.00				0.00			0	0.
Duct Heat	Pkup		C)		0 0.00				0.00	•		0	0.
OV/UNDR S	izing	0				0 0.00			0	0.00	•	0	0	0.
Exhaust H	eat		C	0		0 0.00			•	0.00		J	0	0.
Terminal	Bypass		C	0		0 0.00				0.00	•		0	0.
							*			•	•			
Grand Tota	al==>	25,786	C	0	27,36	9 100.00	*	25	,036	100.00	•	0	0	0.
		• • • • • • • • • • • • • • • • • • • •	coc	LING COIL S	ELECTION				••••	•••••		AREAS		
	Total C	apacity	Sens Cap.	Coil Airfl	Enter	ing DB/WE	/HR	Lea	ving (OB/WB/HR	Gross To	tal GL	ass (sf) (%
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F D	eg F Gra	ins	Deg F	Deg 1	F Grains	Floor	972		
ain Clg	2.5	30.0	29.2	1,000	79.7	58.8	2.9	51.6	46.8	3 47.5	Part	540		
ux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Exfir	0		
pt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	972		0
otals	2.5	30.0									Wall	1,068	(65
	HEATING	COIL SELI	ECTION		A	IRFLOWS (cfm)	*******		-ENGINEERING	CHECKS	TEMPE	PATHOES	(E)-
	Capacity			Lvg	Туре	Cooling	-	Heating		lg % OA	7.8	Type	Clg	Ht
	(Mbh)	(cfi	n) Deg F	-	Vent	78		0		lg Cfm/Sqft	1.03	SADB	51.9	
ain Htg	-0.0		0 0.0		Infil	0		0	_	lg Cfm/Ton	400.00	Plenum	78.0	
ıx Htg	0.0		0 0.0		Supply	1,000		0	_	lg Saft/Ton	388.80	Return	78.0	
eheat	-0.0	1,0	000 1.9		Mincfm	.,		0		lg Btuh/Saft		Ret/OA	79.5	
heat	0.0	•	0 0.0		Return	1,000		0		o. People	5	Runarnd		
umidif	0.0		0.0		Exhaust	78		. 0		tg % OA	0.0	Fn MtrT(
ot Vent	0.0		0 0.0		Pm Fyh					es Cfm/C=C+	0.0	an murit	, 0.1	0

0

Htg Cfm/SqFt

Htg Btuh/SqFt

0.00

0.00

Fn BldTD

Fn Frict 0.2

0.1

0.0

0.0

ROOM PSYCHROMETRICS - ALTERNATIVE 2
BASELINE BUILDING 102

------PSYCHROMETRIC STATE POINTS------

Room 3

	Dry	Wet	Relat.	Humid.		Temp.
	Bulb	Bulb	Humid.	Ratio	Enthalpy	Diff.
	(F)	(F)	(%)	(GR)	(Btu/Lb)	(F)
Space	78.0	58.3	32.0	53.2	27.0	
Main System						
Return Air Heat Pickup						0.0
Return Fan						0.0
Return Air	78.0	58.3	32.0	53.2	27.0	
Outdoor Air	97.3	63.7	16.0	49.0	31.1	
Return/Outdoor Air Mix	79.5	58.8	30.3	52.9	27.4	
Blow through Fan						0.2
Entering Coil	79.7	58.8	30.1	52.9	27.4	
Leaving Coil	51.6	48.1	78.9	52.2	20.5	
Draw Through Fan						0.0
Duct Frictional Heat						0.2
Supply Duct Heat Gain						0.0
Cold Deck Supply Air	51.9	48.1	78.3	52. 2	20.5	
Supply Air	51.9	48.1	78.3	52.2	20.5	

Percent Outside Air 7.78 (%)
Sensible Heat Ratio (SHR) 0.963
Percent Supply Air Bypassing Coil 0.00 (%)
Coil Airflow 1,000 (Cfm)

BUILDING U-VALUES - ALTERNATIVE 2
BASELINE BUILDING 102

------ BUILDING U-VALUES------

Room U-Values										Room	Room	
					(Btu	ı/hr/sqf	t/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	0.310	0.318	0.260	0.000	40.9	8.18
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.127	0.310	0.318	0.260	0.000	85.7	18.04
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.127	0.310	0.318	0.260	0.000	62.2	12.86
3	2ND FLR COOLING	0.388	0.000	0.000	0.000	0.127	0.310	0.318	0.260	0.000	101.3	21.15
Zone	2 Total/Ave.	0.388	0.000	0.000	0.000	0.127	0.310	0.318	0.260	0.000	101.3	21.15
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.127	0.310	0.318	0.260	0.000	64.0	13.26
3	2ND FLR COOLING	0.388	0.000	0.000	0.000	0.127	0.310	0.318	0.260	0.000	101.3	21.15
Zone	2 Total/Ave.	0.388	0.000	0.000	0.000	0.127	0.310	0.318	0.260	0.000	101.3	21.15
System	2 Total/Ave.	0.388	0.000	0.000	0.000	0.127	0.310	0.318	0.260	0.000	101.3	21.15
Buildin	g	0.388	0.750	0.000	0.000	0.127	0.310	0.318	0.260	0.000	65.7	13.62

BUILDING AREAS - ALTERNATIVE 2
BASELINE BUILDING 102

BUILDING ARFAS

Room Number	Description	Number Dupl	er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	10,164	10,164	8,001	465	0	0	0	890	12	6,301
2	2ND FLOOR	1	1	9,191	9,191	4,224	0	0	0	9,191	884	15	4,876
Zone	1 Total/Ave.				19,355	12,225	465	0	0	9,191	1,774	14	•
3	2ND FLR COOLING	1	1	972	972	540	0	0	0	972	65	6	1,003
Zone	2 Total/Ave.				972	540	0	0	0	972	65	6	1,003
System	1 Total/Ave.				20,327	12,765	465	0	0	10,163	1,839	13	12,181
3	2ND FLR COOLING	1	1	972	972	540	0	0	0	972	65	6	1,003
Zone	2 Total/Ave.				972	540	0	0	0	972	65	6	1,003
System	2 Total/Ave.				972	540	0	0	0	972	65	6	1,003
Buildin	g				21,299	13,305	465	0	0	11,135	1,904	13	13,184

System Totals

Percent	Cool	ing Loa	ad	Heatir	ng Load		Cooling	Airflow		Heating	Airflow	•
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.1	9	280	-24,125	16	261	50.0	0	0	0.0	0	0
5 - 10	0.3	8	257	-48,250	13	218	100.0	0	0	0.0	0	0
10 - 15	0.4	7	234	-72,375	17	283	150.0	0	0	0.0	0	0
15 - 20	0.5	7	225	-96,500	13	224	200.0	0	0	0.0	0	0
20 - 25	0.6	6	193	-120,625	10	169	250.0	0	0	0.0	0	0
25 - 30	0.8	6	203	-144,750	6	97	300.0	0	0	0.0	0	0
30 - 35	0.9	4	120	-168,875	7	115	350.0	0	0	0.0	0	0
35 - 40	1.0	8	271	-193,000	8	134	400.0	0	0	0.0	0	0
40 - 45	1.1	6	201	-217,125	8	138	450.0	0	0	0.0	0	0
45 - 50	1.3	9	274	-241,250	2	41	500.0	0	0	0.0	0	0
50 - 55	1.4	8	258	-265,375	0	0	550.0	0	0	0.0	0	0
55 - 60	1.5	6	191	-289,500	0	0	600.0	0	0	0.0	0	0
60 - 65	1.6	6	208	-313,625	0	0	650.0	0	0	0.0	0	0
65 - 70	1.8	5	156	-337,750	0	0	700.0	0	0	0.0	0	0
70 - 75	1.9	3	106	-361,875	0	0	750.0	0	0	0.0	0	0
75 - 80	2.0	0	0	-386,000	0	0	800.0	0	0	0.0	0	0
80 - 85	2.1	1	43	-410,125	0	0	850.0	0	0	0.0	0	0
85 - 90	2.3	0	0	-434,250	0	0	900.0	0	0	0.0	0	0
90 - 95	2.4	0	0	-458,375	0	0	950.0	0	0	0.0	0	0
95 - 100	2.5	0	0	-482,500	0	0	1,000.0	100	3,256	0.0	0	0
Hours Off	0.0	0	5,540	0	0	7,080	0.0	0	5,504	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

 MONI	HLY	ENERGY	CONSUMPTION	

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
1	0.7//	,-	4 007	
Jan	8,366	43	1,003	4
Feb	7,489	43	595	4
March	8,758	43	46	2
April	7,911	46	0	0
May	9,227	47	0	0
June	9,694	47	0	0
July	9,411	47	0	0
Aug	10,254	47	0	0
Sept	8,646	47	0	0
0ct	8,675	47	0	0
Nov	7,806	43	124	2
Dec	7,990	43	657	3
Total	104,227	47	2,427	4

Building Energy Consumption =
Source Energy Consumption =

29,437 (Btu/Sq Ft/Year) 29,806 (Btu/Sq Ft/Year) Floor Area =

20,328 (Sq Ft)

ESOS STUDY AT WSMR - BUILDING 124
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO

weather File Code:	ELPASO.W				
Location:					
Latitude:	31.0	(deg)			
Longitude:	106.0	(deg)			
Time Zone:	6				
Elevation:	3,918	(ft)			

Barometric Pressure:

Summer Clearness Number:	1.00
Winter Clearness Number:	1.00
Summer Design Dry Bulb:	98 (F)
Summer Design Wet Bulb:	64 (F)
Winter Design Dry Bulb:	24 (F)
Summer Ground Relectance:	n 2n

Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

25.8 (in. Hg)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 8: 8:22 1/23/92

Dataset Name: 124 .TM

RAD

- RADIATION

System Block Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: 0 OADB: 24 Space Ret. Air Ret. Air Net Percnt * Percnt * Space Space Peak Coil Peak Sens.+Lat. Sensible Total Of Tot * Latent Sensible Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) * (Btuh) (%) * (Btuh) (Btuh) (%) Skylite Solr 0 0 0.00 * 0.00 * 0 0 0 0.00 Skylite Cond 0 0 0.00 * 0 0 0.00 * 0 0 0.00 Roof Cond 0 0 0.00 * ß 0 0.00 * -70,104 -70.104 6.36 Glass Solar 0 0 0 0.00 * 0.00 * 0 0 0 0.00 Glass Cond 0 0 0.00 * 0 0.00 * -416,467 -416,467 37.79 Wall Cond 0 0 0 0.00 * 0 0.00 * -222,355 -222,355 20.18 Partition ٥ 0.00 * 0 0 0.00 * 0 0 0.00 Exposed Floor 0 0 0.00 * 0 0.00 * 0 0 0.00 Infiltration 0 0.00 * 0 0.00 * -392,993 -392,993 35.66 Sub Total ==> 0.00 * 0 Ω 0 0.00 * -1,101,919 -1,101,919 100.00 Internal Loads Lights 0 0 0 0.00 * 0 0.00 0 0 0.00 People 0 À 0.00 0 0.00 * n O 0.00 Misc 0 0 ۵ n 0.00 * 0 0.00 * 0 0 0.00 Sub Total ==> 0 n U 0 0.00 * 0 0.00 * 0.00 Ceiling Load n n 0 0.00 * 0 0.00 * 0 0 0.00 Outside Air O 0 n 0.00 * 0.00 * 0 O 0.00 Sup. Fan Heat 0.00 * 0.00 * 0 0.00 Ret. Fan Heat O 0.00 * O 0.00 * 0 0.00 Duct Heat Pkup 0 0.00 * Ω 0.00 0.00 OV/UNDR Sizing n 0.00 * 0.00 0 Exhaust Heat O 0 0.00 0.00 0 0 Terminal Bypass 0 0.00 0.00 0.00 Grand Total ==> 0 Ω 0.00 * 0.00 * -1,101,919 -1,101,919 100.00 ------COOLING COIL SELECTION-----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Gross Total Glass (sf) (%) Leaving DB/WB/HR (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains 40,046 Floor Main Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Part 18,194 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 0 Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 13,348 Roof 0 0 Totals 0.0 0.0 6,365 29 Wall 22,202 ------HEATING COIL SELECTION-----------AIRFLOWS (cfm)------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Cooling Type Heating Clg % OA 0.0 Type Clg Hta (Mbh) (cfm) Deg F Deg F Vent 0 0 Clg Cfm/Sqft 0.00 SADB 0.0 76.1 -1,798.4 Main Htg 0 0.0 0.0 Infil 0 7,893 Clg Cfm/Ton 0.00 Plenum 0.0 76.0 Aux Htg 0.0 0.0 0.0 Supply 0 0 Clg Sqft/Ton 0.00 Return 0.0 76.0 Preheat 0.0 0 0.0 0.0 Mincfm 0 0 Clg Btuh/Sqft 0.00 Ret/OA 0.0 76.0 Reheat 0.0 0 0.0 0.0 Return 0 0 No. People 0 Runarnd 0.0 76.0 Humidif 0.0 0 0.0 0.0 Exhaust 0 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0.0 0.0 Rm Exh 0 n Htg Cfm/SqFt 0.00 Fn BldTD 0.0 0.0 Total -1,798.4 Auxil 0 Htg Btuh/SqFt -44.91 En Frict 0.0 0.0

appropriation and

System	2	Peak	PTAC	- PACKAGE	ED TERMINAL	AIR COND	٠.							
*****	*****	******* C	OOLING COIL	PEAK ****	******	*****	***	**** CLG	SPACE	PEAK ****	****** HE	ATING COIL	PEAK 1	*****
Peaked a	t Time =			7/16			*			7/16	*		0/0	
Outside .	Air ==>	OA	DB/WB/HR:	97/ 64/ 49.	.0		*	•	ADB: 9		*	OADB:	0	
			•				*				*			
		Space	Ret. Air	Ret. Air	Net	t Percnt	*	Sp	pace	Percnt	* Space F	eak Coil	Peak	Percnt
		Sens.+Lat.	Sensibl e	Latent	Total	l Of Tot	*	Sensi	ible	Of Tot	* Space S	Sens Tot	Sens	Of Tot
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Bt	tuh)	(%)	* (Bt	uh) (B	tuh)	(%)
Skylit	e Solr	0	0		(0.00	*		0	0.00	*	0	0	0.00
Skylit	e Cond	0	0		(0.00	*		0	0.00	*	0	0	0.00
Roof C	ond	0	0		(0.00	*		0	0.00	*	0	0	0.00
Glass	Solar	11,664	0		11,664	22.87	*	11,	,664	25.38	*	0	0	0.00
Glass	Cond	9,456	0		9,456	5 18.54	. *	9,	,456	20.57	*	0	0	0.00
Wall Co	ond	6,579	0		6,579	12.90	*	6,	,579	14.31	*	0	0	0.00
Partit	ion	0			(0.00	*		0	0.00	*	0	0	0.00
Expose	d Floor	0			(0.00	*		0	0.00	*	0	0	0.00
Infilt	ration	0			(0.00	*		0	0.00	*	0	0	0.00
Sub To	tal==>	27,698	0		27,698	3 54.31	*	27.	,698	60.27	*	0	0	0.00
Internal	Loads				•		*	•			*			
Lights		10,614	0		10,614	20.81	*	10,	,614	23.09	*	0	0	0.00
People		2,100			2,100	4.12	*	1,	, 150	2.50	*	0	0	0.00
Misc		0	. 0	0	. (0.00	*	•	0	0.00	*	0	0	0.00
Sub To	tal==>	12,714	0	0	12,714	24.93	*	11,	,764	25.60	*	0	0	0.00
Ceiling 1	Load	0	0		(0.00	*	-	0	0.00	*	0	0	0.00
Outside /	Air	0	0	0	3,379	6.63	*		0	0.00	*	0	0	0.00
Sup. Fan	Heat				711	1.39	*			0.00	*		0	0.00
Ret. Fan	Heat		0		C	0.00	*			0.00	*		0	0.00
Duct Heat	t Pkup		0		(0.00	*			0.00	*		0	0.00
OV/UNDR S	Sizing	6,497			6,497	12.74	*	6.	497	14.14	*	0	0	0.00
Exhaust (Heat		0	0				-•	,	0.00	*	•	0	0.00
Terminal	Bypass		0	0	C	0.00	*			0.00	*		0	0.00
							*				*		•	••••
Grand Tot	tal==>	46,910	0	0	51,000	100.00	*	45,	960	100.00	*	0	0	0.00
		•••••••	cooi	ING COIL S	ELECTION					******		AREAS-		
	Total	Capacity	Sens Cap.	Coil Airfl	Enteri	ng DB/WB	/HR	Leav	/ing DB	/WB/HR	Gross To		ss (sf	f) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	g F Gra	ins			Grains	Floor	1,555	•	
Main Clg	5.0	60.0	59.5	2,000	80.2 5	8.9 5	2.3	53.8	46.9	44.4	Part	0		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Exflr	0		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	0		0 0
Totals	5.0	60.0									Wall	1,321	4	32 33
	HEATI	NG COIL SELI	ECTION	*****	1A	RFLOWS (cfm)		E	NGINEERIN	G CHECKS	TEMPER	ATURES	(F)
	Capaci			Lvg	Type	Cooling		Heating		% OA	10.5	Type	Clg	Htg
	(Mbh			Deg F	Vent	210		0		Cfm/Sqft	1.29	SADB	54.0	
Main Ktg	-0	.0	0.0	0.0	Infil	0		0	_	Cfm/Ton	400.00	- Plenum	78.0	
Aux Htg	0	.0	0.0	0.0	Supply	2,000		0		Sqft/Ton		Return	78.0	
Preheat	-0	.0 2,0	000 2.5	53.6	Mincfm	. 0		0		Btuh/Sqf		Ret/OA	80.0	
Reheat	0	.0	0.0	0.0	Return	2,000		0	_	People	5	Runarnd	78.0	
Humidif	0	.0	0.0	0.0	Exhaust	210		0		% OA	0.0	Fn MtrTD	0.1	
Opt Vent	0	.0	0.0	0.0	Rm Exh	0		0		Cfm/SqFt	0.00	Fn BldTD	0.1	
Total	0	.0			Auxil	0		0		Btuh/SqF1		Fn Frict	0.1	
					-	·		•	9	3 / Oqi	. 0.00		0.2	. 0.0

ROOM PSYCHROMETRICS - ALTERNATIVE 1
BASELINE BLDG 124

------PSYCHROMETRIC STATE POINTS-----

Room 4

	Dry	Wet	Relat.	Humid.		Temp.
	Bulb	Bulb	Humid.	Ratio	Enthalpy	Diff.
	(F)	(F)	(%)	(GR)	(Btu/lb)	(F)
Space	78.0	58.2	31.8	52.7	27.0	
Main System						
Return Air Heat Pickup						0.0
Return Fan						0.0
Return Air	78.0	58.2	31.8	52.7	27.0	
Outdoor Air	97.3	63.7	16.0	49.0	31.1	
Return/Outdoor Air Mix	80.0	58.8	29.5	52.3	27.4	
Blow through Fan						0.2
Entering Coil	80.2	58.9	29.3	52.3	27.4	
Leaving Coil	53.8	49.0	73.1	52.3	21.0	
Draw Through Fan						0.0
Duct Frictional Heat						0.2
Supply Duct Heat Gain						0.0
Cold Deck Supply Air	54.0	49.1	72.7	52.5	21.1	
Supply Air	54.0	49.1	72.5	52.3	21.1	

Percent Outside Air 10.50 (%)
Sensible Heat Ratio (SHR) 0.980
Percent Supply Air Bypassing Coil 0.00 (%)
Coil Airflow 2,000 (Cfm)

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BLDG 124

: Introduction in interferi

BASELINE BLDG 124

----- Room U-Values -----Room Room (Btu/hr/sqft/F)
Summr Wintr Summr Wintr Mass Capac. Room (lb/ (Btu/ Number Description Part. ExFlr Skylt Skylt Roof Windo Windo Wall Ceil. sqft) sqft/F) 1 1ST FLOOR 0.388 0.000 0.000 0.000 0.000 1.140 1.259 0.270 0.000 6.09 2 2ND FLOOR 0.388 0.000 0.000 0.000 0.000 1.140 1.259 0.270 0.000 30.3 6.05 3 3RD FLOOR 0.388 0.000 0.000 0.000 0.101 1.140 1.259 0.270 0.000 81.8 17.26 1 Total/Ave. 0.388 0.000 0.000 0.000 0.101 1.140 1.259 0.270 0.000 48.2 9.95 4 1ST & 2ND FL CLG 0.000 0.000 0.000 0.000 1.140 1.259 0.270 0.000 29.7 5.94 2 Total/Ave. 0.000 0.000 0.000 0.000 1.140 1.259 0.270 0.000 Zone 29.7 5.94 System 1 Total/Ave. 0.388 0.000 0.000 0.000 0.101 1.140 1.259 0.270 0.000 47.5 9.79 4 1ST & 2ND FL CLG 0.000 0.000 0.000 0.000 1.140 1.259 0.270 0.000 29.7 5.94 2 Total/Ave. 0.000 0.000 0.000 0.000 1.140 1.259 0.270 0.000 Zone 29.7 5.94 2 Total/Ave. 0.000 0.000 0.000 0.000 1.140 1.259 0.270 0.000 System 29.7 5.94 Building 0.388 0.000 0.000 0.000 0.101 1.140 1.259 0.270 0.000 46.8 9.65

D3-58

BUILDING AREAS - ALTERNATIVE 1
BASELINE BLDG 124

------ BUILDING AREAS -----

Room			er of	Floor Area/Dupl Room	Total Floor Area	Partition Area	Exposed Floor Area	Skylight Area	Skl /Rf	Net Roof Area	Window Area	Win /Wl	Net Wall Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	· (sqft)
1	1ST FLOOR	1	1	12,303	12,303	6,065	0	0	0	0	1,770	27	4,721
2	2ND FLOOR	1	1	12,840	12,840	6,065	0	0	0	0	2,041	29	4,948
3	3RD FLOOR	1	1	13,348	13,348	6,065	0	0	0	13,348	2,122	29	5,279
Zone	1 Total/Ave.				38,491	18,194	0	0	0	13,348	5,933	28	14,948
4	1ST & 2ND FL CLG	1	1	1,555	1,555	0	0	0	0	0	432	33	889
Zone	2 Total/Ave.				1,555	0	0	G	0	0	432	33	889
System	1 Total/Ave.				40,046	18,194	0	0	0	13,348	6,365	29	15,837
4	1ST & 2ND FL CLG	1	1	1,555	1,555	0	0	0	0	0	432	33	889
Zone	2 Total/Ave.				1,555	0	0	0	0	0	432	33	889
System	2 Total/Ave.				1,555	0	0	0	0	0	432	33	889
Buildin	g				41,601	18,194	0	0	0	13,348	6,796	29	16,726

System Totals

Percent	Cool	ing Loa	ad	Heati	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	- (%)	
0 - 5	0.3	9	198	-89,921	20	599	100.0	0	. 0	0.0	0	0
5 - 10	0.5	7	153	-179,842	12	376	200.0	0	0	0.0	0	0
10 - 15	0.8	11	241	-269,763	12	358	300.0	0	0	0.0	0	0
15 - 20	1.0	6	141	-359,684	10	313	400.0	0	0	0.0	0	o o
20 - 25	1.3	7	170	-449,605	14	430	500.0	0	0	0.0	0	0
25 - 30	1.5	9	205	-539,526	16	496	600.0	0	0	0.0	0	0
30 - 35	1.8	10	235	-629,447	10	304	700.0	0	0	0.0	0	0
35 - 40	2.0	7	169	-719,368	4	133	800.0	0	0	0.0	0	0
40 - 45	2.3	8	185	-809,289	0	0	900.0	0	0	0.0	0	0
45 - 50	2.5	9	215	-899,210	0	0	1,000.0	0	0	0.0	0	0
50 - 55	2.8	7	166	-989,131	0	0	1,100.0	0	0	0.0	0	0
55 - 60	3.0	3	66	-1,079,052	0	0	1,200.0	0	0	0.0	0	0
60 - 65	3.3	3	65	-1,168,973	0	0	1,300.0	0	0	0.0	0	0
65 - 70	3.5	4	86	-1,258,894	0	0	1,400.0	0	Q	0.0	0	0
70 - 75	3.8	0	0	-1,348,815	0	0	1,500.0	0	0	0.0	0	0
75 - 80	4.0	0	0	-1,438,736	0	0	1,600.0	0	0	0.0	0	0
80 - 85	4.3	0	0	-1,528,657	0	0	1,700.0	0	0	0.0	0	0
85 ~ 90	4.5	0	0	-1,618,578	0	0	1,800.0	0	0	0.0	0	0
90 - 95	4.8	0	0	-1,708,499	0	0	1,900.0	0	0	0.0	0	0
95 - 100	5.0	0	0	-1,798,420	0	0	2,000.0	100	2,312	0.0	0	0
Hours Off	0.0	0	6,465	0	0	5,751	0.0	0	6,448	0.0	0	8,760

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------ MONTHLY ENERGY CONSUMPTION ------

	EFEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kV)	(Therm)	(Thrm/hr)
Jan	17,327	85	4,091	14
Feb	15,627	85	3,373	14
March	17,875	85	1,868	9
April	15,378	85	313	6
May	17,767	99	0	0
June	19,004	100	0	0
July	18,398	100	0	0
Aug	19,776	100	0	0
Sept	16,449	98	0	0
Oct	16,550	97	27	2
Nov	15,957	85	1,703	10
Dec	16,525	85	3,133	12
Total	206,633	100	14,508	14

Building Energy Consumption =
Source Energy Consumption =

51,826 (Btu/Sq Ft/Year) 52,905 (Btu/Sq Ft/Year) Floor Area = 41,601 (Sq Ft)

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**********
**************
     TRACE 600
          ANALYSIS
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ESOS STUDY AT WSMR - BUILDING 124 WHITE SANDS MISSILE RANGE NM US ARMY EMC ENGINEERS, INC. EFFICIENT WINDOWS: ALT 1-BSLN, ALTZ-ECO (CLEAR) (ECO # 9)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft) Air Specific Heat: 0.2444 (Btu/lbm/F) Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft) Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 16:18: 7 1/28/92 Dataset Name:

124 .TM

minimum interes

Grand Total ==>

0

0

0

Infiltration 0 0.00 0.00 * -365,484 -365,484 47.88 Sub Total ==> 0 0.00 0 0.00 -763,300 -763,300 100.00 Internal Loads Lights 0 0 0 0.00 0 0.00 0 0 0.00 People 0 0 0.00 0 0.00 0 n 0.00 Misc 0 0 0 0.00 0 0,00 0 0 0.00 Sub Total ==> 0 0 O n 0.00 0 0.00 0 0.00 Ceiling Load 0 n 0 0.00 0 0.00 0 0.00 Outside Air 0 Ω n 0 0.00 0.00 0 0 0.00 Sup. Fan Heat 0.00 0.00 0 0.00 Ret. Fan Heat 0 0.00 0.00 0 0.00 Duct Heat Pkup 0 0 0.00 0.00 0.00 OV/UNDR Sizing 0 0 0.00 0.00 0 Exhaust Heat 0 0 0 0.00 0.00 0 Terminal Bypass O 0 0 0.00 0.00 O 0.00

													AREAS					
	Total	Capacity	Sens Cap.	Coil Airfl	Ent	ering [B/WB/HR	Lea	ving DE	3/WB/HR	Gross	Total	Glass	(sf)	(%)			
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F	Deg F	Grains	Deg F	Deg F	Grains	Floor	40,046						
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Part	18,194						
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Exflr	0						
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	13,348		0	0			
Totals	0.0	0.0									Wall	22,202	(6,365	29			

0.00 *

n

0.00 *

-763,300

-763,300

100.00

	The state of the s				AIRPLOWS (CIM)			ENGINEERING	CHECKS	TEMPERATURES (F)			
	Capacity	Coil Airfl	Ent	Lvg	Type	Cooling	Heating	Clg % OA	0.0	Type	Clg	Htg	
	(Mbh)	(cfm)	Deg F	Deg F	Vent	0	0	Clg Cfm/Sqft	0.00	SADB	0.0	76.1	
Main Htg	-1,798.4	0	0.0	0.0	Infil	0	7,340	Clg Cfm/Ton	0.00	Plenum	0.0	76.0	
Aux Htg	0.0	0	0.0	0.0	Supply	0	0	Clg Sqft/Ton	0.00	Return	0.0	76.0	
Preheat	0.0	0	0.0	0.0	Mincfm	0	0	Clg Btuh/Sqft	0.00	Ret/OA	0.0	76.0	
Reheat	0.0	0	0.0	0.0	Return	0	0	No. People	0	Runarnd	0.0	76.0	
Humidif	0.0	0	0.0	0.0	Exhaust	0	0	Htg % OA	0.0	Fn MtrTD	0.0	0.0	
Opt Vent	0.0	0	0.0	0.0	Rm Exh	0	0	Htg Cfm/SqFt	0.00	Fn BldTD	0.0	0.0	
Total	-1,798.4				Auxil	0	0	Htg Btuh/SqFt	-44.91	Fn Frict	0.0	0.0	

System	2	Peak	PTAC	- PACKAGE	D TERMINAL	AIR COND.							
*****	*****	****** C	OOLING COIL	PEAK ****	*****	*****	***** CLG	SPACE	PEAK ****	******* HE	ATING COIL	PEAK *1	*****
Peaked a	t Time			7/16					8/16 *	,		0/ 0	
Outside	Air ==>	OA	DB/WB/HR:	97/ 64/ 49.	0		* 0	ADB:	96 *	,	OADB:	0	
							* /		•	•			
		Space	Ret. Air	Ret. Air	Net	Percnt		pace	Percnt *	Space P	eak Coil	Peak	Percnt
		Sens.+Lat.	Sensible	Latent	Total	Of Tot	* Sens	ible	Of Tot *	Space S	ens Tot	Sens	Of Tot
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	* (B	tuh)	(%) *	(Bt	uh) (8	tuh)	(%)
Skylit	e Solr	0	0		0	0.00	*	0	0.00 *	•	0	0	0.00
Skylit		0	0		0	0.00	•	0	0.00	•	0	0	0.00
Roof C	ond	0	0		0	0.00	*	0	0.00	•	0	0	0.00
Glass	Solar	12,096	0		12,096	23.96	* 12	,960	28.20 *	,	0	0	0.00
Glass		2,571	0		2,571	5.09	* 2	,330	5.07 *	•	0	0	0.00
Wall C	ond	6,579	0		6,579	13.03	* 6	,219	13.53 *	•	0	0.	0.00
Partit	ion	0			0	0.00	*	0	0.00 *	•	0	0	0.00
Expose	d Floor	0			0	0.00	*	0	0.00 *		0	0	0.00
Infilt	ration	0			0	0.00	*	0	0.00 *		0	0	0.00
Sub To	tal==>	21,246	0		21,246	42.09	* 21	,509	46.80 *		0	0	0.00
Internal	Loads						*	•	*				****
Lights		10,614	0		10,614	21.03	* 10	,614	23.09 *		0	0	0.00
People		2,100			2,100	4.16	* 1	,150	2.50 *		0	0	0.00
Misc		0	0	0	0	0.00		. 0	0.00 *		0	0	0.00
Sub To	tal==>	12,714	0	0	12,714	25.19	* 11	,764	25.60 *		0	0	0.00
Ceiling (Load	0	0		0	0.00	*	0	0.00 *		0	0	0.00
Outside /	Air	0	0	0	3,120	6.18	*	0	0.00 *		0	0	0.00
Sup. Fan	Heat				711	1.41		-	0.00 *		•	0	0.00
Ret. Fan	Heat		0		0	0.00			0.00 *			0	0.00
Duct Heat	t Pkup		0		0	0.00			0.00 *			0	0.00
OV/UNDR S	Sizing	12,687			12,687	25.13		,687	27.60 *		0	0	
Exhaust 1	Heat	•	0	0	0	0.00	*	,	0.00 *		U	0	0.00
Terminal	Bypass		0	0	0	0.00	*		0.00 *			0	0.00
	•••			•	·	*****	*		v *			U	0.00
Grand Tot	tal==>	46,647	0	0	50,479	100.00	* 45	,960	100.00 *		0	0	0.00
•••••		•••••••	coor	ING COIL S	ELECTION						AREAS-		
	Total	Capacity	Sens Cap.	Coil Airfl	Enterir	ng DB/WB/I	IR Lea	ving DB	J/WB/HR	Gross Tot	tal Gla	ss (sf)	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F Deg	F Grai	ns Deg F	Deg F	Grains	Floor	1,555		,
Main Clg	5.0	60.0	59.5	2,000	80.0 58	3.9 52.	.5 53.8	46.9	44.3	Part	0		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0 0.	.0 0.0	0.0	0.0	ExFlr	0		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0 0.	0.0	0.0	0.0	Roof	0		0 0
Totals	5.0	60.0								Wall	1,321	43	
********	HEATI	NG COIL SELE	CTION		AIR	FLOWS (c1	fm)	E	NGINEERING	CHECKS	TEMPER	ATURES	(F)
	Capaci	ty Coil Ai	irfl Ent	Lvg	Type	Cooling	Heating		% OA	9.8	Туре	Clg	Htg
	(Mbh) (cfi	n) Deg F	Deg F	Vent	195	0		Cfm/Sqft	1.29	SADB	54.0	0.0
Main Htg	-0	1.0	0.0	0.0	Infil	0	0		Cfm/Ton	400.00	Plenum	78.0	0.0
Aux Htg	0	.0	0.0	0.0	Supply	2,000	0	_	Sqft/Ton	311.00	Return	78.0	0.0
Preheat	-0	.0 2,0	000 2.3	53.6	Mincfm	. 0	0		Btuh/Sqft	38.59	Ret/OA	79.9	0.0
Reheat	0	.0	0.0	0.0	Return	2,000	0		People	5	Runarnd	78.0	0.0
Humidif	0	.0	0.0	0.0	Exhaust	195	0		% OA	0.0	Fn MtrTD	0.1	0.0
Opt Vent	0	.0	0.0	0.0	Rm Exh	0	0		Cfm/SqFt	0.00	Fn BldTD	0.1	
Total	0	.0			Auxil	0	0		Btuh/SqFt	0.00			0.0
						•	J	cg	acany adire	3.00	Fn Frict	0.2	0.0

V 600 PAGE 16

ROOM PSYCHROMETRICS - ALTERNATIVE 2 EFFICIENT WINDOWS (CLEAR) BLDG. 124

------PSYCHROMETRIC STATE POINTS-----

Room 4

	Dry	Wet	Relat.	Humid.		Temp.
	Bulb	Bulb	Humid.	Ratio	Enthalpy	Diff.
	(F)	(F)	(%)	(GR)	(Btu/Lb)	(F)
Space	78.0	58.2	31.9	52.9	27.0	
Main System						
Return Air Heat Pickup						0.0
Return Fan						0.0
Return Air	78.0	58.2	31.9	52.9	27.0	
Outdoor Air	97.3	63.7	16.0	49.0	31.1	
Return/Outdoor Air Mix	79.9	58.8	29.7	52.5	27.4	
Blow through Fan						0.2
Entering Coil	80.0	58.9	29.6	52.5	27.4	
Leaving Coil	53.8	49.0	73.4	52.5	21.1	
Draw Through Fan						0.0
Duct Frictional Heat						0.2
Supply Duct Heat Gain						0.0
Cold Deck Supply Air	54.0	49.2	73.0	52.7	21.1	
Supply Air	54.0	49.1	72.8	52.5	21.1	

Percent Outside Air 9.76 (%)
Sensible Heat Ratio (SHR) 0.980
Percent Supply Air Bypassing Coil 0.00 (%)
Coil Airflow 2,000 (Cfm)

BUILDING U-VALUES - ALTERNATIVE 2
EFFICIENT WINDOWS (CLEAR) BLDG. 124

------ BUILDING U-VALUES-----

		••••	Room	Room								
					(Btu	/hr/sqf	t/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST FLOOR	0.388	0.000	0.000	0.000	0.000	0.310	0.318	0.270	0.000	30.5	6.09
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.000	0.310	0.318	0.270	0.000	30.3	6.05
3	3RD FLOOR	0.388	0.000	0.000	0.000	0.101	0.310	0.318	0.270	0.000	81.8	17.26
Zone	<pre>1 Total/Ave.</pre>	0.388	0.000	0.000	0.000	0.101	0.310	0.318	0.270	0.000	48.2	9.95
4	1ST & 2ND FL CLG	0.000	0.000	0.000	0.000	0.000	0.310	0.318	0.270	0.000	29.7	5.94
Zone	2 Total/Ave.	0.000	0.000	0.000	0.000	0.000	0.310	0.318	0.270	0.000	29.7	5.94
System	1 Total/Ave.	0.388	0.000	0.000	0.000	0.101	0.310	0.318	0.270	0.000	47.5	9.79
4	1ST & 2ND FL CLG	0.000	0.000	0.000	0.000	0.000	0.310	0.318	0.270	0.000	29.7	5.94
Zone	2 Total/Ave.	0.000	0.000	0.000	0.000	0.000	0.310	0.318	0.270	0.000	29.7	5.94
System	2 Total/Ave.	0.000	0.000	0.000	0.000	0.000	0.310	0.318	0.270	0.000	29.7	5.94
Buildin	g ·	0.388	0.000	0.000	0.000	0.101	0.310	0.318	0.270	0.000	46.8	9.65

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BUILDING AREAS - ALTERNATIVE 2
EFFICIENT WINDOWS (CLEAR) BLDG. 124

BUILDING AREAS -----

Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	12,303	12,303	6,065	0	0	0	0	1,770	27	4,721
2	2ND FLOOR	1	1	12,840	12,840	6,065	0	0	0	0	2,041	29	4,948
3	3RD FLOOR	1	1	13,348	13,348	6,065	0	0	0	13,348	2,122	29	5,279
Zone	1 Total/Ave.				38,491	18,194	0	0	0	13,348	5,933	28	14,948
4	1ST & 2ND FL CLG	1	1	1,555	1,555	0	0	0	0	0	432	33	889
Zone	2 Total/Ave.				1,555	0	0	0	0	0	432	33	889
System	<pre>1 Total/Ave.</pre>				40,046	18,194	0	0	0	13,348	6,365	29	15,837
4	1ST & 2ND FL CLG	1	1	1,555	1,555	0	0	0	0	0	432	33	889
Zone	2 Total/Ave.				1,555	0	0	0	0	0	432	33	889
System	2 Total/Ave.				1,555	0	0	0	0	0	432	33	889
Buildin	g				41,601	18,194	Ó	0	0	13,348	6,796	29	16,726

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

System Totals

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Percent	Cool	ling Loa	ad	Heati	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.3	13	324	-89,921	21	568	100.0	0	0	0.0	0	o
5 - 10	0.5	10	247	-179,842	15	398	200.0	0	0	0.0	0	0
10 - 15	0.8	9	232	-269,763	10	259	300.0	0	0	0.0	0	0
15 - 20	1.0	8	206	-359,684	17	452	400.0	0	0	0.0	0	0
20 - 25	1.3	9	242	-449,605	16	424	500.0	0	0	0.0	0	0
25 - 30	1.5	8	209	-539,526	13	331	600.0	0	0	0.0	0	0
30 - 35	1.8	11	276	-629,447	8	211	700.0	0	0	0.0	0	0
35 - 40	2.0	10	261	-719,368	0	0	800.0	0	. 0	0.0	0	0
40 - 45	2.3	7	183	-809,289	0	0	900.0	0	0	0.0	0	0
45 - 50	2.5	4	113	-899,210	0	0	1,000.0	0	0	0.0	0	0
50 - 55	2.8	6	167	-989,131	0	0	1,100.0	0	0	0.0	0	0
55 - 60	3.0	3	86	-1,079,052	0	0	1,200.0	0	0	0.0	0	0
60 - 65	3.3	2	43	-1,168,973	0	0	1,300.0	0	0	0.0	0	0
65 - 70	3.5	0	0	-1,258,894	0	0	1,400.0	0	0	0.0	0	0
70 - 75	3.8	0	0	-1,348,815	0	0	1,500.0	0	0	0.0	0	0
75 - 80	4.0	0	0	-1,438,736	0	0	1,600.0	0	0	0.0	0	0
80 - 85	4.3	0	0	-1,528,657	0	0	1,700.0	0	0	0.0	0	0
85 - 90	4.5	0	0	-1,618,578	0	0	1,800.0	0	0	0.0	0	0
90 - 95	4.8	0	0	-1,708,499	0	0	1,900.0	0	0	0.0	0	0
95 - 100	5.0	0	0	-1,798,420	0	0	2,000.0	100	2,643	0.0	0	0
Hours Off	0.0	0	6,171	0	0	6,117	0.0	0	6,117	0.0	0	8,760

 MONTHLY	ENERGY	CONSUMPTION	

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	17,211	85	3,436	10
Feb	15,502	85	2,752	10
March	17,678	85	1,208	7
April	15,279	83	163	4
May	17,818	99	0	0
June	18,787	100	0	0
July	18,071	100	0	0
Aug	19,567	100	0	0
Sept	16,586	98	0	0
0ct	16,599	97	0	0
Nov	15,754	96	1,102	7
Dec	16,455	85	2,530	8
Total	205,305	100	11,192	10

Building Energy Consumption =
Source Energy Consumption =

43,747 (Btu/Sq Ft/Year) 44,579 (Btu/Sq Ft/Year) Floor Area = 41,601 (Sq Ft)

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**************
     TRACE 600
            ANALYSIS
```

WHITE SANDS MISSILE RANGE NM US ARMY EMC ENGINEERS, INC. 3
EFFICIENT WINDOWS: ALT 1-BSLN, ALTZ-ECO (GREY) (ECO #9)

Weather File Code:

ESOS STUDY AT WSMR - BUILDING 124

ELPASO.W

Location:

Latitude:

31.0 (deg)

Longitude:

106.0 (deg)

Time Zone:

6 3,918 (ft)

Elevation: Barometric Pressure:

25.8 (in. Hg)

Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20

Winter Ground Relectance:

0.20

Air Density: Air Specific Heat: 0.0653 (Lbm/cuft) 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod:

0.9575 (Btu-min./hr/cuft/F)

Latent Heat Factor:

4,214.8 (Btu-min./hr/cuft)

Enthalpy Factor:

3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May

To October

System Simulation Period: January To December

Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run:

17: 6:46 1/28/92

Dataset Name:

124 .TM

Block

1

RAD

- RADIATION

System

historical desirior

Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: n OADB: 24 Space Ret. Air Ret. Air Net Percnt * Space Peak Coil Peak Space Percnt * Percnt Sens.+Lat. Sensible Latent Total Of Tot Sensible Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) * (Btuh) (Btuh) (%) Skylite Solr 0 ۵ Ω 0.00 O 0.00 * Λ 0.00 0 Skylite Cond n 0.00 n n 0 0.00 * 0 0 0.00 Roof Cond Ω 0 0 0.00 0 0.00 * -70,104 -70,104 9.16 Glass Solar 0 0 0.00 0.00 * 0 0 0.00 Glass Cond 0 0.00 0.00 * -107,227 0 -107,227 14.01 Wall Cond 0 n 0.00 * 0 0.00 0 -222,355 -222,355 29.06 Partition 0 0 0.00 0 0.00 * 0 0 0.00 Exposed Floor 0 0.00 0.00 * 0 0 0 0 0.00 Infiltration Ω 0.00 0.00 * 0 0 -365,484 -365,484 47.77 Sub Total ==> n 0 0.00 0.00 * -765,169 -765,169 100.00 Internal Loads Lights 0.00 0 0.00 * 0 0 0.00 People 0.00 * 0 0.00 0 0 0 0.00 Misc û 0 Ω O 0.00 0 0.00 * 0 0 0.00 Sub Total ==> Ω 0 0 0 0.00 0 0.00 * 0 0 0.00 Ceiling Load 0 0 0 0.00 0.00 * 0 0 0.00 Outside Air 0 0.00 0.00 0 0 0.00 Sup. Fan Heat 0 0.00 0.00 * 0 0.00 Ret. Fan Heat O 0.00 0.00 * 0 0 0.00 Duct Heat Pkup O O 0.00 * 0.00 * 0.00 OV/UNDR Sizing 0.00 0.00 * 0 Exhaust Heat 0 0.00 0.00 0 0.00 Terminal Bypass 0.00 0.00 0.00 Grand Total ==> 0 O 0.00 * 0.00 * -765,169 -765,169 100.00 -----COOLING COIL SELECTION------------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Glass (sf) (%) Gross Total (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 40,046 Main Clg 0.0 0.0 0.0 Ð 0.0 0.0 0.0 0.0 0.0 0.0 Part 18,194 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Exflr Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.00.0 Roof 13.348 O n Totals 0.0 0.0 Wall 22,202 6,365 29 ------HEATING COIL SELECTION----------AIRFLOWS (cfm)------- ENGINEERING CHECKS---- TEMPERATURES (F)---Capacity Coil Airfl Ent Lvg Type Cooling Heating Clg % OA 0.0 Type Cla Kta (Mbh) (cfm) Deg F Deg F Vent 0 0 Clg Cfm/Sqft 0.00 SADB 0.0 76.1 Main Htg -1,798.4 0 0.0 0.0 Infil 0 7,340 Clg Cfm/Ton 0.00 Plenum 0.0 76.0 Aux Htg 0.0 0 0.0 0.0 n Supply Λ Clg Sqft/Ton 0.00 Return 76.0 Preheat 0.0 0 0.0 0.0 Mincfm n 0 Clg Btuh/Sqft 0.00 Ret/OA 0.0 76.0 0.0 Reheat n 0.0 0.0 Return 0 0 No. People 0 Runarnd 0.0 76.0 Humidif 0.0 Ð 0.0 0.0 Exhaust 0 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0.0 0.0 Rm Exh 0 0 Hta Cfm/SaFt 0.00 Fn BldTD 0.0 0.0 -1,798.4 Total Auxil n Htg Btuh/SqFt -44.91 Fn Frict 0.0

System	2	Peak	PTAC	- PACKAGE	D TERMINAL	AIR COND.	•							
******	*****	******	COOLING COIL	PEAK ****	*****	*****	***	**** CLG	SPACE	PEAK ****	****** HE	ATING COIL	PEAK *	*****
Peaked at	t Time :	==>	Mo/Hr:	7/16			*	Mo/	Hr: 7	7 /16 *	•	Mo/Hr:	0/0	
Outside /	Air ==>	O.	ADB/WB/HR:	97/ 64/ 49.	0		*	OAI	DB: 9	7 *	•	OADB:	0	
		Space	Ret. Air	Ret. Air	Not	Percnt		V		Donont #	Cnaca D	ank Cail	Daal.	D
		Sens.+Lat.	Sensible	Latent	Total		*		ace	Percnt *	•			Percnt
Envelope	I nade	(Btuh)	(Btuh)	(Btuh)	(Btuh)		*	Sensil (Bt		Of Tot *	•		Sens	Of Tot
Skylite		0	0	(B Cull)	(8(31)			(61)	un) 0	(%) * 0.00 *	,,,,		tuh)	(%)
Skylite		0	0		0							0	0	0.00
Roof Co		0	0		-				0	0.00 *		0	0	0.00
Glass S		7,776	0		7 774			. ,	0	0.00 *		0	0	0.00
Glass (_ *	0		7,776			-	776	16.92 *		0	0	0.00
Wall Co		2,617			2,617			•	617	5.69 *		0	0	0.00
Partiti		6,579 0	0		6,579			٥,:	579	14.31 *		0	0_	0.00
		-			0				0	0.00 *		0	0	0.00
•	d Floor	0			0				0	0.00 *		0	0	0.00
Infilte		0			0				0	0.00 *		0	0	0.00
Sub Tot Internal		16,972	0		16,972	33.45	*	16,9	972	36.93 * *		0	0	0.00
Lights		10,614	0		10,614	20.92	*	10,6	514	23.09 *		0	0	0.00
Peopl e		2,100			2,100		*	•	150	2.50 *		0	0	0.00
Misc		0	0	0	0		*	•	0	0.00 *		0	o o	0.00
Sub Tot	tal==>	12,714	0	0	12,714			11,7	764	25.60 *		0	0	0.00
Ceiling L	Load	0	0		0		*		0	0.00 *		0	0	0.00
Outside A	Air	0	0	0	3,120		*		0	0.00 *		0	0	0.00
Sup. Fan	Heat				711	1.40	*		-	0.00 *		· ·	0	0.00
Ret. Fan	Heat		0		0		*			0.00 *			0	0.00
Duct Heat	t Pkup		0		0					0.00 *			0	0.00
OV/UNDR S	Sizing	17,224			17,224			17,2	224	37.48 *		0	0	0.00
Exhaust H	leat	•	0	0	0	0.00		,.		0.00 *		Ü	0	
Terminal	Bypass		0	0	0	0.00				0.00 *			o o	0.00
							*			*			Ů	0.00
Grand Tot	tal==>	46,910	0	0	50,742	100.00	*	45,9	260	100.00 *		0	0	0.00
••••••				ING COIL S	ELECTION			*******			********	AREAS-		
		Capacity	•	Coil Airfl	Enteri	ng DB/WB/	HR	Leavi	ing DB	/WB/HR	Gross To	tal Gla:	ss (sf)	(%)
	(Tons)		(Mbh)	(cfm)		g F Grai	ns	Deg F C	eg F	Grains	Floor	1,555		
Main Clg	5.0		59.5	2,000	80.0 58	3.9 .52	.5	53.8	46.9	44.3	Part	0		
Aux Clg	0.0	0.0	0.0	0			.0	0.0	0.0	0.0	ExFlr	0		
Opt Vent	0.0		0.0	0	0.0	0.0	.0	0.0	0.0	0.0	Roof	0		0 0
Totals	5.0	60.0									Wall	1,321	43	32 33
			ECTION		AIF	RFLOWS (c	fm)		EI	NGINEERING	CHECKS	TEMPER	ATURES	(F)
	Capaci			Lvg	Type	Cooling	1	Heating	Clg	% OA	9.8	Type	Clg	Htg
_	(Mbh		m) Deg F	Deg F	Vent	195		0	Clg	Cfm/Sqft	1.29	SADB	54.0	0.0
Main Htg		0.0	0.0	0.0	Infil	0		0	Clg	Cfm/Ton	400.00	Plenum	78.0	0.0
Aux Htg		.0	0.0	0.0	Supply	2,000		0	Clg	Sqft/Ton	311.00	Return	78.0	0.0
Preheat		-	000 2.3	53.6	Mincfm	0		0	Clg	Btuh/Sqft	38.59	Ret/OA	79.9	0.0
Reheat		.0	0.0	0.0	Return	2,000		0	No.	People	5	Runarnd	78.0	0.0
Humidif		.0	0.0	0.0	Exhaust	195		0	Htg	% OA	0.0	Fn MtrTD	0.1	0.0
Opt Vent		.0	0.0	0.0	Rm Exh	0		0	Htg	Cfm/SqFt	0.00	Fn BldTD	0.1	0.0
Total	0	.0			Auxil	0		0	Htg	Btuh/SqFt	0.00	Fn Frict	0.2	0.0

ROOM PSYCHROMETRICS - ALTERNATIVE 3 EFFICIENT WINDOWS (GRAY) BLDG. 124

------PSYCHROMETRIC STATE POINTS-----

Room 4

	Dry	Wet	Relat.	Humid.		Temp.
	Bulb	Bulb	Humid.	Ratio	Enthalpy	Diff.
	(F)	(F)	(%)	(GR)	(Btu/Lb)	(F)
Space	78.0	58.2	31.9	52.9	27.0	
Main System						
Return Air Heat Pickup						0.0
Return Fan						0.0
Return Air	78.0	58.2	31.9	52.9	27.0	
Outdoor Air	97.3	63.7	16.0	49.0	31.1	
Return/Outdoor Air Mix	79.9	58.8	29.7	52.5	27.4	
Blow through Fan						0.2
Entering Coil	80.0	58.9	29.6	52.5	27.4	
Leaving Coil	53.8	49.0	73.4	52.5	21.1	
Draw Through Fan						0.0
Duct Frictional Heat						0.2
Supply Duct Heat Gain						0.0
Cold Deck Supply Air	54.0	49.2	73.0	52.7	21.1	
Supply Air	54.0	49.1	72.8	52.5	21.1	

Percent Outside Air 9.76 (%)
Sensible Heat Ratio (SHR) 0.980
Percent Supply Air Bypassing Coil 0.00 (%)
Coil Airflow 2,000 (Cfm)

BUILDING U-VALUES - ALTERNATIVE 3
EFFICIENT WINDOWS (GRAY) BLDG. 124

and shinking

-----BUILDING U-VALUES------

		•	Room	Room								
					(Btu	ı/hr/sqf	ft/F)				Mass	Capac.
Room				Summe	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST FLOOR	0.388	0.000	0.000	0.000	0.000	0.315	0.324	0.270	0.000	30.5	6.09
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.000	0.315	0.324	0.270	0.000	30.3	6.05
3	3RD FLOOR	0.388	0.000	0.000	0.000	0.101	0.315	0.324	0.270	0.000	81.8	17.26
Zone	<pre>1 Total/Ave.</pre>	0.388	0.000	0.000	0.000	0.101	0.315	0.324	0.270	0.000	48.2	9.95
4	1ST & 2ND FL CLG	0.000	0.000	0.000	0.000	0.000	0.316	0.324	0.270	0.000	29.7	5.94
Zone	2 Total/Ave.	0.000	0.000	0.000	0.000	0.000	0.316	0.324	0.270	0.000	29.7	5.94
System	1 Total/Ave.	0.388	0.000	0.000	0.000	0.101	0.315	0.324	0.270	0.000	47.5	9.79
4	1ST & 2ND FL CLG	0.000	0.000	0.000	0.000	0.000	0.316	0.324	0.270	0.000	29.7	5.94
Zone	2 Total/Ave.	0.000	0.000	0.000	0.000	0.000	0.316	0.324	0.270	0.000	29.7	5.94
System	2 Total/Ave.	0.000	0.000	0.000	0.000	0.000	0.316	0.324	0.270	0.000	29.7	5.94
Buildin	g	0.388	0.000	0.000	0.000	0.101	0.315	0.324	0.270	0.000	46.8	9.65

BUILDING AREAS - ALTERNATIVE 3
EFFICIENT WINDOWS (GRAY) BLDG. 124

BUILDING AREAS -----

				Floor	Total		Exposed						
		Numb	er of	Area/Dupl	Floor	Partition	Floor	Skylight	Skl	Net Roof	Window	Win	Net Wall
Room		Dupl	icate	Room	Area	Area	Area	Area	/Rf	Area	Area	/Wl	Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	1ST FLOOR	1	1	12,303	12,303	6,065	0	0	0	0	1,770	27	4,721
2	2ND FLOOR	1	1	12,840	12,840	6,065	0	0	0	0	2,041	29	4,948
3	3RD FLOOR	1	1	13,348	13,348	6,065	0	0	0	13,348	2,122	29	5,279
Zone	1 Total/Ave.				38,491	18,194	0	0	0	13,348	5,933	28	14,948
4	1ST & 2ND FL CLG	1	1	1,555	1,555	0	0	0	0	0	432	33	889
Zone	2 Total/Ave.				1,555	0	0	0	0	0	432	33	889
System	1 Total/Ave.				40,046	18,194	0	0	0	13,348	6,365	29	15,837
. 4	1ST & 2ND FL CLG	1	1	1,555	1,555	0	0	0	0	0	432	33	889
Zone	2 Total/Ave.				1,555	0	0	0	0	0	432	33	889
System	2 Total/Ave.				1,555	0	0	0	0	0	432	33	889
Buildin	g				41,601	18,194	Ø	0	0	13,348	6,796	29	16,726

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 3

System Totals

Percent	Cool	ing Loa	ad	Heati	ng Load		Cooling	Airflo		Heating	Airflo	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.3	13	338	-89,921	18	523	100.0	0	0	0.0	0	0
5 - 10	0.5	8	208	-179,842	14	413	200.0	0	0	0.0	0	0
10 - 15	0.8	10	254	-269,763	13	382	300.0	0	0	0.0	0	0
15 - 20	1.0	8	213	-359,684	14	402	400.0	0	0	0.0	0	Ō
20 - 25	1.3	9	226	-449,605	18	527	500.0	0	0	0.0	0	0
25 - 30	1.5	12	313	-539,526	13	370	600.0	0	0	0.0	0	0
30 - 35	1.8	11	281	-629,447	8	239	700.0	0	0	0.0	0	0
35 - 40	2.0	9	234	-719,368	0	0	800.0	0	0	0.0	0	0
40 - 45	2.3	6	155	-809,289	0	0	900.0	0	0	0.0	0	0
45 - 50	2.5	7	169	-899,210	0	0	1,000.0	0	0	0.0	0	0
50 - 55	2.8	4	109	-989, 131	0	0	1,100.0	0	0	0.0	0	0
55 - 60	3.0	1	20	-1,079,052	0	.0	1,200.0	0	0	0.0	0	0
60 - 65	3.3	0	0	-1,168,973	0	0	1,300.0	0	0	0.0	0	0
65 - 70	3.5	0	0	-1,258,894	0	0	1,400.0	0	0	0.0	0	0
70 - 75	3.8	0	0	-1,348,815	0	0	1,500.0	0	0	0.0	0	0
75 - 8 0	4.0	0	0	-1,438,736	0	0	1,600.0	0	0	0.0	0	0
80 - 85	4.3	0	0	-1,528,657	0	0	1,700.0	0	0	0.0	0	0
85 - 90	4.5	0	0	-1,618,578	0	0	1,800.0	0	0	0.0	0	0
90 - 95	4.8	0	0	-1,708,499	0	0	1,900.0	0	0	0.0	0	0
95 - 100	5.0	0	0	-1,798,420	0	0	2,000.0	100	2,557	0.0	0	0
Hours Off	0.0	0	6,240	0	0	5,904	0.0	0	6,203	0.0	0	8.760

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MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3

Building Energy Consumption =

Source Energy Consumption =

**********	••••••	М	ONTHL	YENER	G Y
	ELEC	DEMAND	GAS	GAS DMND	
	On Peak	On Peak	On Peak	On Peak	
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)	
Jan	17,280	85	3,655	10	
Feb	15,584	85	2,989	10	
March	17,756	85	1,489	7	
April	15,310	83	234	4	
May	17,693	98	0	0	
June	18,561	100	0	0	
July	17,843	100	0	0	
Aug	19,367	100	0	0	
Sept	16,385	97	0	0	
Oct	16,574	97	8	2	
Nov	15,899	85	1,381	7	
Dec	16,525	85	2,777	8	
Total	204,777	100	12,532	10	

46,926 (Btu/Sq Ft/Year)

47,858 (Btu/Sq Ft/Year)

Floor Area =

41,601 (Sq Ft)

D3-77

ESOS STUDY AT WSMR - BUILDING 128
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO *9)

Weather File Code: ELPASO.W Location: 31.0 (deg) Latitude: Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F)

Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:52: 3 1/ 3/92
Dataset Name: 128 .TM

RAD

System

Northbolileo

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Block - RADIATION Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 0 OADB: OAD8: 24 Space Ret. Air Ret. Air Net Percnt * Space Percnt * Space Peak Coil Peak Percnt Sens.+Lat. Sensible Latent Total Of Tot Sensible Of Tot Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr 0 O 0.00 * n Ω 0.00 0 0 0.00 Skylite Cond Λ O n 0.00 * 0 0.00 0 0 0.00 Roof Cond 0 0 0.00 0.00 -86,746 -86,746 9.19 Glass Solar 0 0 0.00 0 0.00 Ω 0 0.00 Glass Cond 0 0 0.00 0 0 0.00 -266,247 -266,247 28.22 Wall Cond 0 0 0 0.00 0 0.00 -248,874 -248,874 26.37 Partition 0 0 0.00 0 0.00 0 0 0.00 Exposed Floor 0 U 0.00 0 0.00 -28,776 -28,776 3.05 Infiltration 0 0 0.00 0.00 * 0 -312,956 -312,956 33.17 Sub Total==> 0 0 0.00 0.00 -943,598 -943,598 100.00 Internal Loads Lights 0 0.00 0 0.00 * 0 0 0.00 People 0 0 0.00 0 0.00 * 0 0 0.00 Misc 0 0 O 0 0.00 * 0 0.00 * 0 0 0.00 Sub Total ==> 0 0 0 0 0.00 0 0.00 * 0 0 0.00 Ceiling Load 0 0 0 0.00 0 0.00 * 0 0 0.00 Outside Air 0 0 0 0.00 0.00 0 0 0.00 Sup. Fan Heat 0 0.00 0.00 * Ω 0.00 Ret. Fan Heat 0 0 0.00 * 0.00 * 0 0.00 Duct Heat Pkup O 0.00 * 0 0.00 * OV/UNDR Sizing n 0 0.00 * 0.00 0 Exhaust Heat 0 0.00 * 0.00 ٥ Terminal Bypass 0.00 * 0.00 0 0.00 Grand Total ==> 0 0 0 0.00 * 0.00 * -943,598 -943,598 100.00 ------COOLING COIL SELECTION-----------APFAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 42,830 Main Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Part 16,612 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 FxFlr 872 Opt Vent 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 14,496 0 0 Totals 0.0 0.0 Wall 26,150 4,806 ------HEATING COIL SELECTION----------AIRFLOWS (cfm)------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Lvg Type Cooling Heating Clg % OA 0.0 Clg Htg Type (Mbh) (cfm) Deg F Deg F Vent 0 n Clg Cfm/Sqft 0.00 SADB 0.0 68.1 Main Htg -1,284.6 0 0.0 0.0 Infil 0 7,428 Clg Cfm/Ton 0.00 Plenum 0.0 68.0 Aux Htg 0.0 0 0.0 0.0 Supply n 0 Clg Sqft/Ton 0.00 Return 0.0 68.0 Preheat 0.0 0.0 0 0.0 Mincfm n 0 Clg Btuh/Sqft 0.00 Ret/OA 0.0 68.0 Reheat 0.0 0 0.0 0.0 Return 0 No. People 0 Runarnd 0.0 68.0 Humidif 0.0 0.0 0.0 Exhaust 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0.0 0.0 Rm Exh ۵ 0 Htg Cfm/SqFt 0.00 Fn BldTD 0.0 0.0 Total -1,284.6 Auxil 0 Htg Btuh/SqFt -29.99 Fn Frict 0.0 0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 128

------ BUILDING U-VALUES-----

										Room Mass	Room Capac.	
Room Number	Description	Part.	Exflr	Summr Skylt	Wintr Skylt	•		Wintr Windo	Wali	Ceil.	(lb/sqft)	(Btu/sqft/F)
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.265	0.000	43.9	8.78
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.000	1.140	1.259	0.265	0.000	36.3	7.26
3	3RD FLOOR	0.388	0.000	0.000	0.000	0.136	1.140	1.259	0.265	0.000	87.8	18.45
Zone	<pre>1 Total/Ave.</pre>	0.388	0.750	0.000	0.000	0.136	1.140	1.259	0.265	0.000	56,2	11.54
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.136	1.140	1.259	0.265	0.000	56.2	11.54
Buildin	9	0.388	0.750	0.000	0.000	0.136	1.140	1.259	0.265	0.000	56.2	11.54

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 128

BUILDING ARFAS

Room			er of icate	Floor Area/Dupl Room	Total Floor Area	Partition Area	Exposed Floor Area	Skylight Area	Skl /Rf	Net Roof Area	Window Area	Win /Wl	Net Wall Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	1ST FLOOR	1	1	13,835	13,835	10,346	872	0	0	0	1,602	18	7,115
2	2ND FLOOR	1	1	14,499	14,499	3,133	0	0	0	0	1,602	18	7,115
3	3RD FLOOR	1	1	14,496	14,496	3,133	0	0	0	14,496	1,602	18	7,115
Zone	<pre>1 Total/Ave.</pre>				42,830	16,612	872	0	0	14,496	4,806	18	21,344
System	1 Total/Ave.				42,830	16,612	872	0	0	14,496	4,806	18	21,344
Buildin	g				42,830	16,612	872	0	0	14.496	4.806	18	21.344

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1
BASELINE BUILDING 128

System Totals

Percent	Cool	ing Loa	ad	Heati	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-64,230	19	383	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-128,460	14	279	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-192,690	13	268	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-256,920	11	225	0.0	0	0	0.0	0	Õ
20 - 25	0.0	0	0	-321,150	13	261	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-385,380	16	336	0.0	0	0	0.0	0	0
30 - 35	0.0	. 0	0	-449,610	9	175	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-513,840	5	112	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-578,070	0	0	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-642,300	0	0	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-706,530	0	0	. 0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-770,760	0	0	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-834,990	0	0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-899,220	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-963,450	0	0	0.0	0	0	0.0	0	0
75 ~ 80	0.0	0	0	-1,027,680	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	. 0	-1,091,910	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-1,156,140	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-1,220,370	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-1,284,600	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,721	0.0	0	8,760	0.0	0	8,760

สมัมถึงจดินผู้ผู้

------ MONTHLY ENERGY CONSUMPTION ------

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	14,831	68	2,878	11
Feb	13,411	68	2,057	11
March	14,027	68	253	6
April	11,693	64	0	0
May	12,708	64	0	0
June	12,631	64	0	0
July	11,770	64	0	0
Aug	13,177	. 64	0	0
Sept	11,693	64	0	0
Oct	12,708	64	0	0
Nov	13,306	68	409	5
Dec	14,362	68	1,918	9
Total	156,314	68	7,514	11

Building Energy Consumption = 30,000 (Btu/Sq Ft/Year)
Source Energy Consumption = 30,543 (Btu/Sq Ft/Year)

Floor Area = 42,830 (Sq Ft)

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TRACE 600
         ANALYSIS
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ESOS STUDY AT WSMR - BUILDING 128 WHITE SANDS MISSILE RANGE NM US ARMY EMC ENGINEERS, INC. EFFICIENT WINDOWS: ALT 1-BSLN, ALTZ-ECO (CA EAR) (ECO #9)

Weather File Code: ELPASO.W Location:

Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation:

3,918 (ft) Barometric Pressure: 25.8 (in. Hg)

Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20

Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft) Air Specific Heat: 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) 4,214.8 (Btu-min./hr/cuft) Latent Heat Factor: Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 13:28: 1 1/20/92 Dataset Name: 128 .TM

Block

RAD

- RADIATION

System

1

Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: 0 OADB: 24 Space Ret. Air Ret. Air Net Percnt * Space Percnt * Space Peak Coil Peak Percnt Sens.+Lat. Sensible Latent Total Of Tot Sensible Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr 0 ۵ 0.00 n 0.00 * Ω n 0 0.00 Skylite Cond 0 0 n 0.00 0.00 * 0 0 0 0.00 Roof Cond 0 n 0.00 O 0 0.00 * -86,746 -86,746 12.00 Glass Solar Ω O 0.00 0.00 * 0 0 0 0.00 Glass Cond n 0 √ -67,335 0.00 0 0.00 * -67,335 9.32 Wall Cond 0 0.00 0 0.00 * -248,874 -248,874 34.43 Partition O 0,00 0 0.00 * 0 0 0.00 Exposed Floor 0 0.00 0 0.00 * -28,776 -28,776 3.98 Infiltration n 0.00 0 0.00 * -291,049 -291,049 40.27 Sub Total ==> 0 0.00 n 0.00 * -722,780 -722,780 100.00 Internal Loads Lights n n 0.00 0 0.00 * 0 0 0.00 People 0 0.00 0.00 * 0 0 0 0.00 Misc 0 O 0.00 0 0.00 * 0 0 0.00 Sub Total ==> 0 ٥ 0 0 0.00 0.00 * 0 n 0.00 Ceiling Load Ω 0 0.00 0 0 0.00 Λ n 0.00 Outside Air 0 0 0.00 0.00 * n a 0.00 Sup. Fan Heat 0 0.00 0.00 * 0.00 Ret. Fan Heat 0 0.00 0.00 * O 0.00 Duct Heat Pkup Ð 0.00 0.00 * a 0.00 OV/UNDR Sizing 0 0.00 0.00 O 0 Exhaust Heat n 0 0.00 0.00 0 Terminal Bypass 0.00 0.00 0.00 Grand Total ==> 0.00 * 0.00 * -722,780 -722,780 100.00 ------COOLING COIL SELECTION----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/KR **Gross Total** Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 42,830 Main Clg 0.0 0.0 0.0 ٥ 0.0 0.0 0.0 0.0 0.0 0.0 Part 16,612 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Exfir 872 Opt Vent 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 14,496 0 0 Totals 0.0 0.0 Wall 26,150 4,806 18 ------HEATING COIL SELECTION----------AIRFLOWS (cfm)------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Lva Type Cooling Heating Clg % OA 0.0 Type Clg Htg (Mbh) (cfm) Deg F Deg F Vent 0 Λ Clg Cfm/Sqft 0.00 SADB 0.0 68.1 Main Htg -1,284.6 0 0.0 0.0 Infil Ω 6,908 Clg Cfm/Ton 0.00 Plenum 0.0 68.0 Aux Htg 0.0 0 0.0 0.0 Supply 0 Clg Sqft/Ton 0.00 Return 0.0 68.0 Preheat 0.0 n 0.0 0.0 Mincfm Clg Btuh/Sqft 0.00 Ret/OA 0.0 68.0 Reheat 0.0 Ð 0.0 0.0 Return 0 0 No. People 0 Runarnd 0.0 68.0 Humidif 0.0 0.0 0.0 Exhaust Ω 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0.0 0.0 Rm Exh ٥ 0 Htg Cfm/SqFt 0.00 Fn BldTD 0.0 0.0 Total -1,284.6 Auxil ٥ Htg Btuh/SqFt -29.99 Fn Frict 0.0 0.0

D3-86

BUILDING U-VALUES - ALTERNATIVE 2 EFFICIENT WINDOWS - BLDG. 128

------ BUILDING U-VALUES-----

		Room U-Values(Btu/hr/sqft/F)										Room Capac.	
Room			-	Summr	Wintr		Summr	Wintr			(lb/	(Btu/	
Number	Description	Part.	Exflr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)	
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	0.310	0.318	0.265	0.000	43.9	8.78	
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.000	0.310	0.318	0.265	0.000	36.3	7.26	
3	3RD FLOOR	0.388	0.000	0.000	0.000	0.136	0.310	0.318	0.265	0.000	87.8	18.45	
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.136	0.310	0.318	0.265	0.000	56.2	11.54	
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.136	0.310	0.318	0.265	0.000	56.2	11.54	
Buildin	g	0.388	0.750	0.000	0.000	0.136	0.310	0.318	0.265	0.000	56.2	11.54	

BUILDING AREAS - ALTERNATIVE 2 EFFICIENT WINDOWS - BLDG. 128

BUILDING AREAS ------

Room Number	Descri		Numbe Dupli Flr	er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	/Rf	Net Roof Area (sqft)	l ndo lre	a/Wl	
1	1ST FL	DOR	1	1	13,835	13,835	10,346	872	0	0	0	.60	2 18	7, 5
2	2ND FL	DOR	1	1	14,499	14,499	3,133	. 0	0	0	0	,60	2 18	•
. 3	3RD FLO	DOR	1	1	14,496	14,496	3,133	0	0	0	14,496	,60		•
Zone	1	Total/Ave.				42,830	16,612	872	0	0	14,496	,80		•
System	1 '	Total/Ave.				42,830	16,612	872	0	0	14,496	.80		- •
Buildin ‡	ig					42,830	16,612	872	0	0	14,496	,80	-	

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2 EFFICIENT WINDOWS - BLDG. 128

System Totals

Percent	Cool	ling Lo	ad	Heati	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-64,230	20	367	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-128,460	18	329	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-192,690	14	254	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-256,920	14	268	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-321,150	12	231	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-385,380	11	199	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-449,610	10	191	0.0	0	0	0.0	0	Ö
35 - 40	0.0	0	0	-513,840	2	31	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-578,070	0	0	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-642,300	0	0	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-706,530	0	0	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-770,760	0	0	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-834,990	0	. 0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-899,220	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-963,450	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-1,027,680	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-1,091,910	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-1,156,140	0	0	0.0	0	0	0.0	0	0
90 ~ 95	0.0	0	0	-1,220,370	0	0	0.0	0	0	0.0	0	0
95 ~ 100	0.0	0	0	-1,284,600	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,890	0.0	0	8,760	0.0	0	8,760

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***************************************	*********	MONTHL	YENERGY	CONSUMPTION
EL	EC DEMAN	D GAS	GAS DMND	
On Pe	ak On Pea	k On Peak		
Month (kW	h) (kW) (Therm)	(Thrm/hr)	

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	14,831	68	2,506	8
Feb	13,243	68	1,639	8
March	13,999	68	207	5
April	11,693	64	0	0
May	12,708	64	0	0
June	12,631	64	0	0
July	11,770	64	0	0
Aug	13,177	64	0	0
Sept	11,693	64	0	0
0ct	12,708	64	0	0
Nov	12,337	68	280	5
Dec	13,686	68	1,585	7
Total	154,474	68	6,218	8

Building Energy Consumption = Source Energy Consumption = 26,827 (Btu/Sq Ft/Year) 27,276 (Btu/Sq Ft/Year)

Floor Area = 42,830 (Sq Ft)

ESOS STUDY AT WSMR - BUILDING 129
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.

EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO**9)

Weather File Code:	ELPASO	.w
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	

Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 13:55:42 1/22/92
Dataset Name: 129 .TM

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Total

-1,057.0

PAGE 3

1 System Block RAD - RADIATION Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADR: 0 OADB: 24 Space Ret. Air Ret. Air Net Percnt * Percnt * Coil Peak Space Space Peak Percnt Sens.+Lat. Sensible Latent Total Of Tot * Sensible Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) * (Btuh) (Btuh) (%) Skylite Solr 0 Ω ß 0.00 n 0.00 * 0 0 0.00 Skylite Cond 0.00 n n ۵ 0 0.00 * 0 0.00 Roof Cond 0 0 0 0.00 0.00 * -59,808 -59,808 10.91 Glass Solar 0 0 0 0.00 0 0.00 * 0 0.00 0 Glass Cond 0 0 0 0.00 0.00 * 0 -139,673 -139,673 25.49 Wall Cond ۵ O n 0.00 0.00 * 0 -155,054 -155,054 28.29 Partition 0 0 0.00 0 0.00 * 0 0 0.00 Exposed Floor 0 0 0.00 0.00 * 0 0 0 0.00 -193,491 Infiltration 0 0 0.00 0.00 * 0 -193,491 35.31 Sub Total ==> n 0 0 0.00 0.00 * -548,026 -548,026 Internal Loads Lights 0 0.00 0 0.00 * 0 0 0.00 People 0 0.00 0 0 0.00 * 0 0 0.00 Misc 0 0 0.00 * 0 0 0.00 * 0 0 0.00 Sub Total ==> ۵ 0 0 0 0.00 0 0.00 * 0 0 0.00 Ceiling Load Ω 0 0 0.00 0 0.00 * 0 0 0.00 Outside Air 0 0 0 0.00 * 0.00 * 0 0.00 Sup. Fan Heat 0.00 0 0.00 * 0 0.00 Ret. Fan Heat 0 0 0.00 * 0.00 * 0 0.00 Duct Heat Pkup 0 0 0.00 * 0.00 * 0 0.02 OV/UNDR Sizing Λ 0.00 * 0.00 * 0. Exhaust Heat ۵ 0 0 0.00 * 0.00 * 0 0.00 Terminal Bypass 0.00 * 0.00 * 0.00 Grand Total ==> 0 0 0.00 * 0.00 * -548,026 -548,026 100.00 -----COOLING COIL SELECTION-----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Mbh) (Tons) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 24,714 Main Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Part 8,482 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr O Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 Roof 12,357 0 n Totals 0.0 0.0 Vai I 15,819 2,521 16 -----HEATING COIL SELECTION---------- AIRFLOWS (cfm)-------- ENGINEERING CHECKS---- TEMPERATURES (F)---Capacity Coil Airfl Ent Lvg Type Cooling Heating Clg % OA 0.0 Type Clg Hta (Mbh) (cfm) Deg F Deg F Vent 0 0 Clg Cfm/Sqft 0.00 SADB 0.0 68.1 Main Htg -1,057.0 0 0.0 0.0 Infil 0 4,593 Clg Cfm/Ton 0.00 Plenum 0.0 68.0 Aux Htg 0.0 0 0.0 0.0 Supply n Λ Clg Sqft/Ton 0.00 Return 0.0 68.0 Preheat 0.0 0 0.0 0.0 Mincfm O 0 Clg Btuh/Sqft 0.00 Ret/OA 0.0 68.0 0.0 Reheat O 0.0 0.0 Return 0 0 No. People 0 Runarnd 0.0 68.0 Humidif 0.0 0.0 0,0 Exhaust 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0.0 0.0 Rm Exh Ð n Htg Cfm/SqFt 0.00 Fn BldTD 0.0 0.0

D3-92

Auxil

n

Htg Btuh/SqFt

-42.77

Fn Frict

System	2	Block	UH	- UNIT HEATERS
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Peaked at	Time ==	:>	Mo/Hr:	0/0			-	MO	/Hr:	0/0 1	•	Mo/Hr:	13/ 1	
Outside Ai	ir ==>	OA	DB/WB/HR:	0/ 0/ 0	.0		*		ADB:	0 •	•	OADB:		
		Space	Ret. Air	Ret. Air	Ne	t Percr	*		pace	Percnt '	· · Space P	lack Cail	Peak	Percnt
	S	Sens.+Lat.	Sensible		Tota			Sens	•	Of Tot	•		Sens	Of Tot
Envelope t		(Btuh)	(Btuh)		(Btuh				tuh)	(%)			Btuh)	(%)
Skylite		0	0	•		0 0.0		,,,	0	0.00	(0	0	0.00
Skylite		0	0)		0 0.0			ō	0.00	•	0	0	0.00
Roof Cor	nd	0	0	1		0 0.0	0 *		0	0.00	•	0	0	0.00
Glass Sc	olar	0	0)		0.0	0 *		0	0.00		0	0	0.00
Glass Co	ond	0	0	1		0.0	0 *		0	0.00	-12,	466 -1	2,466	35.27
Wall Cor	nd	0	0	1		0.0	0 *		0	0.00	•	0	. 0	0.00
Partitio	on	0				0.0	0 *		0	0.00	-8,	589 -	8,589	24.30
Exposed	Floor	. 0				0.0	0 *		0	0.00	•	0	. 0	0.00
Infiltra	ation	0				0.0	0 *		0	0.00	-14,	289 -1	4,289	40.43
Sub Tota	al==>	0	0)		0.0	0 *		0	0.00			5,344	100.00
Internal L	.oads						*			,	•		•	
Lights		0	0	1		0.0	0 *		0	0.00	,	0	0	0.00
People		0				0.0	0 *		0	0.00	•	0	0	0.00
Misc		0	0	0		0.0	0 *		0	0.00	•	0 .	0	0.00
Sub Tota	i==>	0	0	0		0.0	0 *		0	0.00	•	0	0	0.00
Ceiling Lo	oad	0	0	1		0.0	0 *		0	0.00	•	0	0	0.00
Outside Ai	ir	0	0	0		0.0	0 *		0	0.00	•	0	0	0.00
Sup. Fan H	leat					0.0	0 *			0.00	•		0	0.00
Ret. Fan H	leat		0		1	0.0	0 *			0.00	•		0	0.00
Duct Heat	•		0	1	1	0.0	0 *			0.00	•		0	0.00
OV/UNDR Si	•	0			1	0.0	0 *		0	0.00	•	0	0	0.00
Exhaust He			0	*	1	0.0				0.00	,		0	0.00
Terminal B	Bypass		0	0	1	0.0	0 *			0.00	•		0	0.00
Grand Tota	.1	•	0				*		_	*				
diana lota	1(>	0	0	. 0	,	0.0	0 *		0	0.00	-35,	344 -3	5,344	100.00
			coo	LING COIL S	ELECTION							AREAS		• • • • • • •
		Capacity	Sens Cap.	Coil Airfl		ing DB/W		Lea	ving D	B/WB/HR	Gross To	tal Gl	ass (sf	f) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	-	eg F Gr		Deg F	_	Grains	Floor	3,634		
lain Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0		Part	6,052		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0		ExFlr	0		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	0		0 0
Totals	0.0	0.0									Wall	225	2	225 100
	-HEATIN	G COIL SEL	ECTION		А	IRFLOWS	(cfm)		•-	ENGINEERING	CHECKS	TEMPE	RATURES	S (F)
	Capacit	y Coil A	irfl Ent	Lvg	Type	Coolin	g i	Heating	Cl	g % OA	0.0	Type	Clg	Нtg
	(Mbh)	-	m) Deg F	Deg F	Vent		0	0	Cl	g Cfm/Sqft	0.00	SADB	0.0	92.9
lain Htg	-80.	2 1,	480 36.4	92.9	Infil		0	339		g Cfm/Ton	0.00	Plenum	0.0	
lux Htg	0.1	0	0.0	0.0	Supply		0	1,480	cl	g Sqft/Ton	0.00	Return	0.0	
reheat	0.0	0	0.0	0.0	Mincfm		0	0		g Btuh/Sqft	0.00	Ret/OA	0.0	
Reheat	0.0	0	0.0	0.0	Return		0	1,480	No	. People	0	Runarnd		
lumidif	0.0		0.0	0.0	Exhaust		0	0		g % OA	0.0	Fn MtrT		
Opt Vent	0.1	0	0.0	0.0	Rm Exh		0	0	Ht	g Cfm/SqFt	0.41	Fn BldTi	0.0	
otal	-80.	2			Auxil		0	0	Ht					

BUILDING U-VALUES - ALTERNATIVE 1

BASELINE BUILDING 129

------ BUILDING U-VALUES------

						Roo	m U-Val	ues				Room	Room
						(Btu	/hr/sqf	t/F)				Mass	Capac.
Room					Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Desc	ription	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST F	LOOR	0.124	0.000	0.000	0.000	0.000	1.140	1,259	0.265	0.000	43.8	8.75
2	2ND F	LOOR	0.124	0.000	0.000	0.000	0.110	1.140	1.259	0.265	0.000	97.1	20.31
Zone	1	Total/Ave.	0.124	0.000	0.000	0.000	0.110	1.140	1.259	0.265	0.000	70.4	14.53
System	1	Total/Ave.	0.124	0.000	0.000	0.000	0.110	1.140	1.259	0.265	0.000	70.4	14.53
3	BASEM	ENT	0.177	0.000	0.000	0.000	0.000	1.140	1.259	0.000	0.000	44.4	8.88
Zone	2	Total/Ave.	0.177	0.000	0.000	0.000	0.000	1.140	1.259	0.000	0.000	44.4	8.88
System	2	Total/Ave.	0.177	0.000	0.000	0.000	0.000	1.140	1.259	0.000	0.000	44.4	8.88
Buildin	g		0.146	0.000	0.000	0.000	0.110	1.140	1.259	0.265	0.000	67.1	13.81

BUILDING AREAS - ALTERNATIVE 1 BASELINE BUILDING 129

Floor Total Exposed Number of Area/Dupl Floor Partition Floor Skylight Skl Net Roof Window Win Net Wa Room **Duplicate** Room Area Area Area Area /Rf Area Area /Wl Number Description Flr Rm (sqft) (sqft) (sqft) (sqft) (sqft) (%) (sqft) (sqft) (%) (sqft) 1 1ST FLOOR 12,357 12,357 4,132 0 0 0 1,261 6,446 16 2 2ND FLOOR 12,357 12,357 4,350 0 0 0 12,357 1,261 6,852 16 Zone 1 Total/Ave. 24,714 8,482 0 0 0 12,357 2,521 16 13,298 System 1 Total/Ave. 24,714 8,482 0 0 0 12,357 2,521 13,298 16 3 BASEMENT 1 3,634 3,634 6,052 0 0 0 0 225 100 0 Zone 2 Total/Ave. 3,634 6,052 0 0 0 0 225 100 0 28,348 1/ System 2 Total/Ave. 0 0 0 225 100 0 0 Building 0 0 0 12,357 2,746 13,298

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System Totals

Percent	Cool	ing Loa	nd	Heatir	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-56,856	26	668	74.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-113,712	17	420	148.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-170,568	16	396	222.0	0	0	0.0	0	0_
15 - 20	0.0	0	0	-227,424	18	448	296.0	0	0	0.0	0	o
20 - 25	0.0	0	0	-284,280	14	351	370.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-341,136	9	239	444.0	. 0	0	0.0	0	0
30 - 35	0.0	0	0	-397,992	0	0	518.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-454,848	0	0	592.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-511,704	0	0	666.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-568,560	0	0	740.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-625,416	0	0	814.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-682,272	0	0	888.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-739,128	0	0	962.0	0	. 0	0.0	0	0
65 - 70	0.0	0	0	-795,984	0	0	1,036.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-852,840	0	0	1,110.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-909,696	0	0	1,184.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-966,552	, 0	0	1,258.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-1,023,408	0	0	1,332.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-1,080,264	0	0	1,406.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-1,137,120	0	0	1,480.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,238	0.0	0	. 0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

 - MONTHLY	ENERGY	CONSUMPTION

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	9,908	45	1,733	6
Feb	8,821	45	1,300	6
March	10,259	45	219	3
April	7,739	45	0	0
May	8,411	43	0	0
June	8,360	43	0	0
July	7,790	43	0	0
Aug	8,721	43	0	0
Sept	7,739	43	0	0
Oct	8,411	43	0	0
Nov	8,767	45	363	3
Dec	9,598	45	1,250	5
Total	104,524	45	4,865	6

Building Energy Consumption =
Source Energy Consumption =

29,745 (Btu/Sq Ft/Year) 30,275 (Btu/Sq Ft/Year) Floor Area =

28,348 (Sq Ft)

Market Chiefe

TRACE 600 ANALYSIS ** *********************

ESOS STUDY AT WSMR - BUILDING 129 WHITE SANDS MISSILE RANGE NM US ARMY EMC ENGINEERS, INC. EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (CLEAR)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft) Air Specific Heat: 0.2444 (Btu/lbm/F) Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft) Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 15:43:39 1/23/92

Dataset Name: 129 .TM વાસમાંમાંમાં

Opt Vent

Total

0.0

-1,057.0

0.0

0.0

Rm Exh

Auxil

System 1 Block RAD - RADIATION

Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: 0 OADB: 24 Ret. Air Ret. Air Percnt * Space Net Percnt * Coil Peak Space Space Peak Percnt Sens.+Lat. Sensible Total Of Tot * Of Tot * Latent Sensible Space Sens Tot Sens Of Tot (Btuh) Envelope Loads (Btuh) (%) * (Btuh) (Btuh) (%) (8tuh) (Btuh) (Btuh) (%) Skylite Solr ٥ 0.00 * 0 0 0 0.00 0 0 0.00 Skylite Cond 0 0 0 0.00 0.00 0 0 0 0.00 Roof Cond 0 0 0 0.00 0 0.00 -59,808 -59,808 13.90 Glass Solar 0 0 0.00 0.00 * n Λ / 0 0 0.00 0 Glass Cond 0 n 0.00 0 0.00 * -35,324 -35,324 8.21 Wall Cond 0 0 0.00 0.00 -155,054 -155,054 36.05 Partition 0 0.00 0 0.00 * ຄ 0 0.00 / O Exposed Floor 0 n 0.00 0.00 * O 0 0.00 Infiltration 0 0 0.00 0 0.00 -179,947 -179,947 41.84 Sub Total==> Đ 0.00 -430,133 0.00 -430,133 100.00 Internal Loads Lights 0 0.00 * 0 Ω 0.00 * 0 0 0 0.00 People Ω 0.00 * 0 0 0.00 * 0 0.00 Misc 0 0 0.00 * 0.00 * 0 0 0.00 Sub Total==> 0 0.00 * 0 0.00 0 O 0.00 Ceiling Load 0 0.00 0.00 * 0 0 0 0.00 Outside Air 0 0.00 0.00 * 0 0 0.00 Sup. Fan Heat 0.00 0 0.00 0.00 Ret. Fan Heat 0 ۵ 0.00 0.00 0 0.00 Duct Heat Pkup 0 0 0.00 0.00 0 0.00 OV/UNDR Sizing 0 0.00 0.00 0 0 Exhaust Heat 0 0 0 0.00 0.00 0 Terminal Bypass 0.00 0.00 0.00 Grand Total ==> 0.00 * -430,133 100.00 0.00 * -430,133 ------COOLING COIL SELECTION----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 24,714 Main Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Part 8,482 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 0 Opt Vent 0.0 0.0 0.0 ٥ 0.0 0.0 0.0 0.0 0.0 0.0 Roof 12,357 Totals 0.0 0.0 Wall 15,819 2.521 16 ------HEATING COIL SELECTION-----------AIRFLOWS (cfm)-------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Type Lvg Cooling Heating Clg % OA 0.0 Type Clg Hta (Mbh) (cfm) Deg F Deg F 0 Vent 0 Clg Cfm/Sqft 0.00 SADB 0.0 68.1 Main Htg -1,057.0 0 0.0 0.0 Infil 0 4,271 Clg Cfm/Ton 0.00 Plenum 0.0 68.0 Aux Htg 0.0 0 0.0 0.0 Supply 0 0 Clg Sqft/Ton 0.00 Return 0.068.0 Preheat 0.0 0 0.0 0.0 Mincfm 0 0 Clg Btuh/Sqft 0.00 Ret/OA 0.0 68.0 Reheat 0.0 0 0.0 0.0 No. People Return 0 0 0 Runarnd 0.0 68.0 Humidif 0.0 0 0.0 0.0 Exhaust n 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0

D3-98

0

0

Htg Cfm/SqFt

Htg Btuh/SqFt

0.00

-42.77

Fn BldTD

Fn Frict

0.0

0.0

0.0

0.0

offennenting

Opt Vent

Total

0.0

0.0

-80.2

0

0

0.0

0.0

0.0

0.0

Exhaust

Rm Exh

Auxil

Peaked a	t Time =	=>	Mo/Hr:	0/ 0			*	Mo/Hr:	0/0	*	Mo/Hr:	PEAK	
Outside	Air ==>	O/	ADB/WB/HR:	0/ 0/ 0.	.0		*	OADB:	0	*	OADB:		
		•					*			*	onbb.		
		Space	Ret. Air	Ret. Air	Ne	t Percnt	*	Space	Percnt	* Space Pe	eak Coil	Peak	Perci
		Sens.+Lat.	Sensible	Latent	Tota	l Of Tot	*	Sensible		•		Sens	Of To
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)		* (Bti		Btuh)	(7
Skylit	e Solr	0	()	(0.00	*	0		t	0	0	0.0
Skylit	e Cond	0	C)	(0.00	*	0	0.00	*	0	0	0.0
Roof C	ond	0	C)	(0.00	*	0	0.00	•	0	0	0.0
Glass	Solar	0	C)	(0.00	*	0	0.00	*	0	0	0.0
Glass	Cond	0	C)	(0.00	*	0		* -3,1	153 -	3,153	12.1
Wall C	ond	0	C)	(0.00	*	0		*	0	0	0.0
Partit	ion	0			(0		· -8,5		8,589	33.0
Expose	d Floor	0			(0	0.00	٠,٠	0	0,507	0.0
Infilt	ration	0			(*	0	0.00			4,289	54.8
Sub To	tal==>	0	0)	Č		*	0	0.00			-	
Internal	Loads				`		*	·		* -26,0 *	550 -2	6,030	100.0
Lights		0	0	1	(0.00	*	0	0.00	•	0	^	
People		0			ì		*	0	0.00	•	0	0	0.0
Misc		0	0	0	ì			0	0.00		0	0	0.0
Sub To	tal==>	0	0		Č			0	0.00		0	0	0.0
Ceiling	Load	0	0	_	Ċ		*	0	0.00		0	0	0.0
Outside .		0	0		Ċ		*	0	0.00		-	0	0.0
Sup. Fan		_	•	•	C		*	·			0	0	0.0
Ret. Fan			0		Ò		*		0.00			0	0.0
Duct Hea			0		0		*					0	0.0
OV/UNDR	•	0	•		0		*	0	0.00		^	0	0.0
Exhaust	•	_	0	0	0		*	U	, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		0	0	0.0
Terminal	Bypass		0	=	0		*					0	0.0
	-,,		·	v	•	0.00			0.00			0	0.0
Grand To	tal==>	0	0	0	0	0.00	_						
		·	U	U	·	0.00	-	0	0.00	-26,0	30 -2	6,030	100.0
			coo	LING COIL S	ELECTION						AREAS		
	Total	Capacity	Sens Cap.	Coil Airfl		ng DB/WB/	'HR	Leaving	DB/WB/HR	Gross Tot			f) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)		g F Grai			F Grains	Floor	3,634	333 (31) (%)
ain Clg	0.0	0.0	0.0	0	· ·	Ī	.0	0.0 0.		Part	-		
ux Clg	0.0	0.0	0.0	0			.0	0.0 0.		ExFlr	6,052 0		
pt Vent	0.0	0.0	0.0	0			.0	0.0 0.		Roof	0		
otals	0.0						•••	0.0 0.	0 0.0	Wall	225	2	0 (25 100
	UCATT	NC COLL CELL	F071011										
			ECTION		AI				-ENGINEERING		TEMPE	RATURES	(F)
	Capaci: (Mbh)	-		Lvg	Туре	Cooling	Heat		lg % OA	0.0	Type	Clg	Нtg
ain Pta			-	-	Vent	0			lg Cfm/Sqft	0.00	SADB	0.0	86.4
ain Htg	-80.	•	480 29.8		Infil	0			lg Cfm/Ton	0.00	Plenum	0.0	68.1
ux Htg	0.		0.0	0.0	Supply	0	1	,480 0	lg Sqft/Ton	0.00	Return	0.0	68.0
reheat	0.		0 0.0	0.0	Mincfm	0		0 0	lg Btuh/Sqft	0.00	Ret/OA	0.0	68.0
eheat		.0	0 0.0	0.0	Return	0	1	,480 N	o. People	0	Runarnd	0.0	68.0
umidif	0.	. 0	0 0.0	0.0	Exhaust			n u	4 04				

0

0

0

0

0

Htg % QA

Htg Cfm/SqFt

Htg Btuh/SqFt

0.0

0.41

-22.06

Fn MtrTD

Fn BldTD

Fn Frict

0.0

0.0

0.0

0.0

0.0

0.0

BUILDING U-VALUES - ALTERNATIVE 2
EFFICIENT WINDOWS (CLEAR) BLDG. 129

-----BUILDING U-VALUES------

		Room Mass	Room Capac.										
Room					Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Desc	ription	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST F	LOOR	0.124	0.000	0.000	0.000	0.000	0.310	0.318	0.265	0.000	43.8	8.75
2	2ND F	LOOR	0.124	0.000	0.000	0.000	0.110	0.310	0.318	0.265	0.000	97.1	20.31
Zone	1	Total/Ave.	0.124	0.000	0.000	0.000	0.110	0.310	0.318	0.265	0.000	70.4	14.53
System	1	Total/Ave.	0.124	0.000	0.000	0.000	0.110	0.310	0.318	0.265	0.000	70.4	14.53
3	BASEM	IENT	0.177	0.000	0.000	0.000	0.000	0.310	0.318	0.000	0.000	44.4	8.88
Zone	2	Total/Ave.	0.177	0.000	0.000	0.000	0.000	0.310	0.318	0.000	0.000	44.4	8.88
System	2	Total/Ave.	0.177	0.000	0.000	0.000	0.000	0.310	0.318	0.000	0.000	44.4	8.88
Buildin	g		0.146	0.000	0.000	0.000	0.110	0.310	0.318	0.265	0.000	67.1	13.81

BUILDING AREAS - ALTERNATIVE 2
EFFICIENT WINDOWS (CLEAR) BLDG. 129

Floor Total Exposed Number of Area/Dupl Floor Partition Floor Skylight Skl Net Roof Window Win Net Wall Room Duplicate Room Area Area Area Area /Rf Area Area /Wl Number Description (sqft) Flr (sqft) (sqft) (sqft) (sqft) (%) (sqft) (sqft) (%) (sqf 1 1ST FLOOR 12,357 12,357 1 1 4,132 0 0 0 0 1,261 6,446 2 2ND FLOOR 12,357 12,357 4,350 6,852 0 12,357 1,261 Zone 1 Total/Ave. 24,714 8,482 0 12,357 2,521 16 13,298 System 1 Total/Ave. 24,714 8,482 0 0 12,357 2,521 16 13,298 3 BASEMENT 1 3,634 3,634 6,052 0 0 0 0 225 100 0 Zone 2 Total/Ave. 3,634 6,052 0 0 0 0 225 100 0 2 Total/Ave. System 3,634 6,052 0 0 0 225 100 0 Building 28,348 14,534 0 0 0 12,357 2,746 13,298 SYSTEM LOAD PROFILE -----

System Totals

Perce	ent	Cool	ing Loa	ad	Heati	ng Load		Cooling	Airflo	,	Heating	Airflo	1
Des	ign	Cap.	Hours	Hours	Capacity	Hours		Cap.		Hours	Cap.	Hours	Hours
Lo	oad	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 -	5	0.0	0	0	-56,856	25	561	74.0	0	0	0.0	0	0
5 -	10	0.0	0	0	-113,712	22	496	148.0	0	0	0.0	0	0
10 -	15	0.0	0	0	-170,568	18	398	222.0	0	0	0.0	0	0
15 -	20	0.0	0	0	-227,424	14	311	296.0	0	0	0.0	0	Õ
20 -	25	0.0	0	0	-284,280	17	395	370.0	0	0	0.0	0	0
25 -	30	0.0	0	0	-341,136	5	112	444.0	0	0	0.0	0	0
30 -	35	0.0	0	0	-397,992	0	0	518.0	0	0	0.0	0	0
35 •	40	0.0	0	0	-454,848	0	0	592.0	0	0	0.0	0	0
40 -	45	0.0	0	0	-511,704	0	0	666.0	0	0	0.0	0	0
45 -	50	0.0	0	0	-568,560	0	0	740.0	0	0	0.0	0	0
50 -	55	0.0	. 0	0	-625,416	0	0	814.0	0	0	0.0	0	0
55 -	60	0.0	0	0	-682,272	0	0	888.0	0	0	0.0	0	0
60 -	65	0.0	0	0	-739,128	0	0	962.0	0	0	0.0	0	0
65 -	70	0.0	0	0	-795,984	0	0	1,036.0	0	0	0.0	0	0
70 -	75	0.0	0	0	-852,840	0	0	1,110.0	0	0	0.0	0	0
75 -	80	0.0	0	0	-909,696	0	0	1,184.0	0	0	0.0	0	0
80 -	85	0.0	0	0	-966,552	0	0	1,258.0	0	0	0.0	0	0
85 -	90	0.0	0	0	-1,023,408	0	0	1,332.0	0	0	0.0	0	0
90 -	95	0.0	0	0	-1,080,264	0	0	1,406.0	0	0	0.0	0	0
95 -	100	0.0	0	0	-1,137,120	0	0	1,480.0	100	8,760	0.0	0	0
Hours	Off	0.0	0	8,760	0	0	6,487	0.0	0	0	0.0	0	8.760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

------ MONTHLY ENERGY CONSUMPTION -----

	ELEC On Deak	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	9,908	45	1,579	5
Feb	8,921	45	1,102	5
March	9,178	45	165	3
April	7,739	43	0	0
May	8,411	43	0	0
June	8,360	43	0	0
July	7,790	43	0	0
Aug	8,721	43	0	0
Sept	7,739	43	0	0
Oct	8,411	43	0	0
Nov	8,334	45	222	3
Dec	9,598	45	1,111	4
Total ·	103,110	45	4,179	5

Building Energy Consumption =
Source Energy Consumption =

27,157 (Btu/Sq Ft/Year) 27,613 (Btu/Sq Ft/Year) Floor Area = 28,348 (Sq Ft)

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ESOS STUDY AT WSMR - BUILDING 143
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO # Q)

Weather File Code:

ELPASO.W

Location:

Latitude: 31.0 (deg)
Longitude: 106.0 (deg)
Time Zone: 6

Elevation:

3,918 (ft)

Barometric Pressure:

25.8 (in. Hg)

Summer Clearness Number: 1.00
Winter Clearness Number: 1.00
Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20

Winter Ground Relectance:

0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)

Latent Heat Factor: Enthalpy Factor:

4,214.8 (Btu-min./hr/cuft)
3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run:

9:40:48 1/23/92

Dataset Name:

143 .TM

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-1,057.0

Total

System	1	Block	RAD	- RADIAT	ION										
*****	*****	*****	COOLING COIL	. PEAK ****	*****	*****	*****	*****	CLG S	SPACE	PEAK ****	*****	MEATING CO	DIL PEAK	**
	at Time =	=>	Mo/Hr:	0/0				*	Mo/H	ir: (0/0	*	Mo/Hr	: 13/ 1	
Outside	Air ==>	0.	ADB/WB/HR:	0/ 0/ 0	.0			*	OAD	B:	0	*	OADE	3: 24	
		Space	Ret. Air	Ret. Air		Net	Percnt	*	Spa	ace	Percnt	~ * Space	Peak Co	oil Peak	Percn
		Sens.+Lat.	Sensible	Latent	Te	otal (Of Tot	*	Sensib	le	Of Tot			ot Sens	Of To
Envelope	e Loads	(Btuh)	(Btuh)	(Btuh)	(B	tuh)	(%)	*	(Btu	ıh)	(%)	•	Btuh)	(Btuh)	(%
Skylii	te Solr	0	0			0	0.00	*		0	0.00		0	0	0.0
Skylii	te Cond	0	0			0	0.00	*		0	0.00		0	0	0.0
Roof (Cond	0	0			0	0.00	*		0	0.00	-5	9,808	-59,808	10.9
Glass	Solar	0	0			0	0.00	*		0	0.00		0	. 0	0.0
Glass	Cond	0	0			0	0.00	*		0	0.00	-13	9,673 -	139,673	25.4
Wall (Cond	0	0			0	0.00	*		0	0.00			155,054	28.2
Parti	tion	0				0	0.00	*		0	0.00		0	0	0.0
Expose	ed Floor	0				0	0.00	*		0	0.00		0	ō	0.0
Infilt	ration	0				0	0.00	*		0	0.00	-10	-	193,491	35.3
Sub To	tal==>	0	0			0	0.00	*		0	0.00		-	548,026	100.00
Internal	Loads							*		•	,	,	0,020	340,020	100.00
Lights	3	0	0			0	0.00	*		0	0.00		0	0	0.0
People	•	0				0	0.00	*		0	0.00		0	0	
Misc		0	0	0		0		*		0	0.00		0	0	0.0
Sub To	tal==>	0	0	0		0		*		0	0.00		0	0	0.00
Ceiling	Load	0	0	_		0		*		0	0.00		0	0	0.00
Outside	Air	0	0	0		0		*		0	0.00	,	0	0	0.00
Sup. Fan	Heat					0		ŵ		•	0.00	•	U	0	0.00
Ret. Fan	Heat		0			0		*			0.00	,		0	0.00
Duct Hea	t Pkup		0			0		*			0.00	,		0	0.00
OV/UNDR	Sizing	0				0		*		0	0.00 *	,	0	0	0.00
Exhaust	Heat		0	0		0	0.00	*		•	0.00	•	v	0	
Terminal	Bypass		0	0		0	0.00	*			0.00 *			0	0.00
Grand To	tal==>	0	0	0		0	0.00	*		0	0.00 *	-548	3,026 -	548,026	100.00
			cool	ING COIL S	ELECTION								ARE/	19	
	Total	Capacity	Sens Cap.	Coil Airfl	Ent	ering	DB/WB/H	IR	Leavir	ng DB,	/WB/HR	Gross T		 Glass (sf) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F	Deg F	Grain	s Deg	F De	eg F	Grains	Floor	24,714		
lain Clg	0.0	0.0	0.0	0	0.0	0.0	0.	0 0	.0	0.0	0.0	Part	8,482		
ux Cig	0.0	0.0	0.0	0	0.0	0.0	0.	0 0	.0	0.0	0.0	ExFlr	0		
pt Vent	0.0	0.0	0.0	0	0.0	0.0	0.	0 0	.0	0.0	0.0	Roof	12,357		0 0
otals	0.0	0.0										Wall	15,819	2,5	
	HEATIN	G COIL SEL	ECTION			-AIRFL	DWS (cfi	m)		F1	NGINEERING	CHECKS	TEMD	PERATURES	(E)
	Capacit			Lvg	Туре		oling	Heati			% OA	0.0			
	(Mbh)	(cfi		Deg F	Vent		0				Cfm/Sqft	0.00		. ctg 0.0	Htg 68.1
ain Htg	-1,057.	0	0.0	0.0	Infil		0	4.1	593		Cfm/Ton	0.00			
ux Htg	0.	0	0.0	0.0	Supply		0	٠,٠	0		Sqft/Ton	0.00			
reheat	0.		0 0.0	0.0	Mincfm		0		0		Btuh/Sqft	0.00			
eheat	0.		0 0.0	0.0	Return		0		Ó		People	0.00			68.0
umidif	0.		0 0.0	0.0	Exhaust		0		0		% OA				68.0
pt Vent	0.		0 0.0	0.0	Rm Exh		0		0			0.0			0.0
	1 057						v		J	nrg	Cfm/SqFt	0.00	Fn Bld	TD 0.0	0.0

Htg Btuh/SqFt -42.77

0.0

Fn Frict 0.0

Auxil

System	2	Block	UH	- UNIT HEATERS

	at Time =		COOLING COIL	. PEAK **** 0/ 0						E PEAK ****	******* H	EATING COI		******
	Air ==>		ADB/WB/HR:	0/ 0/ 0	•				0/Hr:	0/ 0	*	Mo/Hr:		
Jucoruc	XII	·	ADD/ WO/ HK.	0/ 0/ 0	.0			" (DADB:	0	*	OADB:	24	
		Space	Ret. Air	Ret. Air	N-	et Pe	rent '	* 9	Space	Percnt	* Space	Peak Coi	l Peak	Percnt
		Sens.+Lat.	Sensible	Latent	Tot	al Of	Tot '		sible	Of Tot			t Sens	Of Tot
Envelope	e Loads	(Btuh)	(Btuh)	(Btuh)	(Btu	h)	(%)		Stuh)	(%)			(Btuh)	(%)
Skyli	te Solr	0	0	1		0 (0.00		0		*	0	0	0.00
Skyli	te Cond	0	0			0 (0.00	•	0	0.00	*	0	0	0.00
Roof (Cond	0	0	i		0 (0.00	•	0	0.00	*	0	0	0.00
Glass	Solar	0	0			0 (0.00	•	0	0.00	*	0	0	0.00
Glass	Cond	0	0			0 (0.00	•	0	0.00	* -12		12,466	35.27
Wall (Cond	0	0			0 (0.00	•	0	0.00		0	0	0.00
Parti	tion	0				0 0	0.00	•	0	0.00	* -8		-8,589	24.30
Expose	ed Floor	0				0 0	0.00	•	0	0.00		0	0	0.00
Infili	tration	0				0 0	0.00	•	0	0.00	* -14	-	14,289	40.43
Sub To	otal==>	0	0			0 0	0.00 *	,	0	0.00			35,344	100.00
Internal	Loads							,		,	k	,	,	
Lights	3	0	0			0 0	.00 *		0	0.00	*	0	0	0.00
People	2	0				0 0	.00 *		0	0.00	•	0	0	0.00
Misc		0	0	0		0 0	.00 *	•	0	0.00		0	0	0.00
Sub To	tal==>	0	0	0		0 0	.00 *		0	0.00	•	0	0	0.00
Ceiling	Load	0	0			0 0	.00 *		0	0.00	,	0	0	0.00
Outside		0	0	0		0 0	.00 *		0	0.00	•	0	o	0.00
Sup. Fan						0 0	.00 *			0.00	•		0	0.00
Ret. Fan			0			0 0	.00 *			0.00	•		0	0.00
Duct Hea	•		0			0 0	.00 *			0.00	,		0	0.00
OV/UNDR	•	0				0 0	.00 *		0	0.00	•	0	0	0.00
Exhaust	-		0	0		0 0	.00 *			0.00	•		0	0.00
Terminal	Bypass		0	0		0 0	.00 *			0.00	•		0	0.00
A		_					*			*	•			
Grand To	tal==>	0	0	0		0 0	.00 *		0	0.00 *	-35,	344 -3	5,344	100.00
			cool	ING COIL S	ELECTION						********	ADEAG	,	
	Total	Capacity		Coil Airfl		ing DB	/WB/HR	Lea	ving Di	B/WB/HR	Gross To	ANEAS	ass (sf	. (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F D	eg F	Grains	Deg F	Deg F	Grains	Floor	3,634	433 (31)	/ (~)
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Part	6,052		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Exflr	0		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	0		0 0
Totals	0.0	0.0									Wall	225	22	25 100
	HEATIN	G COIL SEL	ECTION		A	TDEL OU	c (afm							
	Capacit	y Coil A		Lvg	Type	Cooli		Heating		NGINEERING			RATURES	(F)
	(Mbh)			Deg F	Vent	0000	0	nearing 0	-	% OA	0.0	Type	Clg	Htg
Main Htg	-80.	_	480 36.4	92.9	Infil		0	339		Cfm/Sqft	0.00	SADB	0.0	92.9
Aux Htg	0.	•	0 0.0	0.0	Supply		0	1,480		Cfm/Ton	0.00	Plenum	0.0	68.0
Preheat	0.	0	0 0.0	0.0	Mincfm		0	•		Sqft/Ton	0.00	Return	0.0	68.0
Reheat	0.		0 0.0	0.0	Return		0	1 /80		Btuh/Sqft		Ret/OA	0.0	68.0
Humidif	0.		0 0.0	0.0	Exhaust		0	1,480		People	. 0	Runarnd	0.0	68.0
Opt Vent	0.		0 0.0	0.0	Rm Exh		0	0		% OA	0.0	Fn MtrTi		0.0
Total	-80.				Auxil		0			Cfm/SqFt	0.41	Fn BldTi	,	0.0
	_						U	0	HTG	Btuh/SqFt	-22.06	Fn Fric	t 0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 143

------ BUILDING U-VALUES-----

												Room Mass	Room Capac.
Room		•			Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Desc	ription	Part.	Exflr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST F	LOOR	0.124	0.000	0.000	0.000	0.000	1.140	1.259	0.265	0.000	43.8	8.75
2	2ND F	LOOR	0.124	0.000	0.000	0.000	0.110	1.140	1.259	0.265	0.000	97.1	20.31
Zone	1	Total/Ave.	0.124	0.000	0.000	0.000	0.110	1.140	1.259	0.265	0.000	70.4	14.53
System	1	Total/Ave.	0.124	0.000	0.000	0.000	0.110	1.140	1.259	0.265	0.000	70.4	14.53
3	BASEM	ENT	0.177	0.000	0.000	0.000	0.000	1.140	1.259	0.000	0.000	44.4	8.88
Zone	2	Total/Ave.	0.177	0.000	0.000	0.000	0.000	1.140	1.259	0.000	0.000	44.4	8.88
System	2	Total/Ave.	0.177	0.000	0.000	0.000	0.000	1.140	1.259	0.000	0.000	44.4	8.88
Buildin	g		0.146	0.000	0.000	0.000	0.110	1.140	1.259	0.265	0.000	67.1	13.81

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 143

BUILDING AREAS -----

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			Me work	er of	Floor Area/Dupl	Total Floor	Partition	Exposed	مادنا فالم	01.1	Non-Book			1
					•			Floor	Skylight	Skl	Net Roof	Window	Win	Net ₩
Room			Dupl	icate	Room	Area	Area	Area	Area	/Rf	Area	Area	/Wl	Area
Number	Desc	ription	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	157	FLOOR	1	1	12,357	12,357	4,132	0	0	0	0	1,261	16	6,446
2	2ND	FLOOR	1	1	12,357	12,357	4,350	0	0	0	12,357	1,261	16	6,852
Zone	1	Total/Ave.				24,714	8,482	0	0	0	12,357	2,521	16	13,298
System	1	Total/Ave.				24,714	8,482	0	0	0	12,357	2,521	16	13,298
3	BASE	MENT	1	1	3,634	3,634	6,052	0	0	0	0	225	100	0
Zone	2	? Total/Ave.				3,634	6,052	0	0	0	0	225	100	0
System		! Total/Ave.				3,634	6,052	0	0	0	0	225	100	0
Buildin	g					28,348	14,534	0	0	0	12,357	2,746	17	13,298

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

System Totals

Percent	Cool	ing Loa	nd	Heati	ng Load		Cooling	Airflo		Heating	Airflow	,
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.		Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-56,856	26	668	74.0	0	a	0.0	0	O
5 - 10	0.0	0	0	-113,712	17	420	148.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-170,568	16	396	222.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-227,424	18	448	296.0	0	0	0.0	0	ō
20 - 25	0.0	0	0	-284,280	14	351	370.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-341,136	9	239	444.0	0	0	0.0	-	0
30 - 35	0.0	0	0	-397,992	0	0	518.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-454,848	0	0	592.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-511,704	0	0	666.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-568,560	0	0	740.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-625,416	0	0	814.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-682,272	0	0	888.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-739,128	0	0	962.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-795,984	0	0	1,036.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-852,840	0	0	1,110.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-909,696	0	0	1,184.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-966,552	0	0	1,258.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-1,023,408	0	0	1,332.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-1,080,264	0	0	1,406.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-1,137,120	0	0	1,480.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,238	0.0	0	0	0.0	0	8,760

-	М	٥	N	T	н	t.	Y	Ε	N	E	R	G	Υ	- 1	C	o	N	S	u	М	Р	Ť	Ī	۵	M	-

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	9,908	45	1,733	6
Feb	8,821	45	1,300	6
March	10,259	45	219	3
April	7,739	45	0	0
May	8,411	43	0	0
June	8,360	43	0	0
July	7,790	43	0	0
Aug	8,721	43	0	0
Sept	7,739	43	0	0
0ct	8,411	43	0	0
Nov	8,767	45	363	3
Dec	9,598	45	1,250	5
Total	104,524	45	4,865	6

Building Energy Consumption =
Source Energy Consumption =

29,745 (Btu/Sq Ft/Year) 30,275 (Btu/Sq Ft/Year)

Floor Area ≖

28,348 (Sq Ft)

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ESOS STUDY AT WSMR - BUILDING 143
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (CLEAR) (ECORG)

Weather File Code:	ELPASO	-W
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 16:13:32 1/23/92 Dataset Name: 143 .TM Block

RAD

- RADIATION

1

System

	at Time =:			0/ 0	•			-	0/0	*	Mo/Hr:		
Outside	Air ≖=>	OA	ADB/WB/HR:	0/ 0/ 0.	0		* (DADB:	0 ,	*	OADB:	24	
		Space	Ret. Air	Ret. Air	Net	Percnt	* 9	Space	Percnt 1	 * Space P	Peak Coil	Peak	Percnt
	:	Sens.+Lat.	Sensible		Total			ible	Of Tot	•		Sens	Of Tot
Envelope	e Loads	(Btuh)	(Btuh)		(Btuh)	(%)		Stuh)		•		Btuh)	(%)
•	te Solr	0	0		0	0.00	*	0		*	0	0	0.00
Skylii	te Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof (Cond	0	0		0	0.00	*	0		+ -59.	,808 -59	9,808	13.90
Glass	Solar	0	0		0	0.00	*	0	0.00		0	. 0	0.00
Glass	Cond	0	0		0	0.00	*	0	0.00		.324 -35	5,324	8.21
Wall (Cond	0	0		0	0.00	•	0	0.00	-		5,054	36.05
Partit	tion	0			0	0.00	*	0	0.00	_	0	0	0.00
Expose	ed Floor	0			0	0.00	*	0	0.00	+	0	0	0.00
Infili	tration	0			0	0.00	*	0	0.00	-179		9,947	41.84
Sub To	otal==>	0	0		0	0.00	*	0	0.00			133	100.00
Internal	Loads				_		*	•	,	•	133	,	
Lights	s	0	0		0	0.00	*	0	0.00	•	0	0	0.00
People		0			0		*	0	0.00		0	0	0.00
Misc		0	0	0	0	0.00	*	0	0.00		0	0	0.00
	otal==>	0	0		0		*	0	0.00		0	0	0.00
Ceiling		0	0	-	0	0.00	*	0	0.00	•	0	0	0.00
Outside		0	0	0	0		*	0	0.00	.	0	0	0.00
Sup. Far	n Heat				0		*	-	0.00	•	•	0	0.00
Ret. Far	n Heat		0		0		*		0.00	•		0	0.00
Duct Hea	at Pkup		0		0		*		0.00			0	0.00
OV/UNDR	Sizing	0			0	0.00	*	0	0.00	•	0	0	
Exhaust	Heat		0	0	0	0.00	*		0.00 *	•	-	0	
Terminal	Bypass		0	0	0	0.00	*		0.00 *	t		0	0.00
O 7	A-1	•					*		*				
Grand To	cal==>	0	0	0	0	0.00	*	0	0.00 +	-430,	133 -430	, 133	100.00
• • • • • • • • • • • • • • • • • • • •				ING COIL S	ELECTION						AREAS-		
		Capacity	•	Coil Airfl	Enterin	g DB/WB/I			3/WB/HR	Gross To	tal Gla	ss (sf) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)		F Grai	ns Deg F	Deg F	Grains	Floor	24,714		
Main Clg	0.0	0.0	0.0	0	0.0 0	.0 0	.0 0.0	0.0	0.0	Part	8,482		
Aux Clg	0.0	0.0	0.0	0	0.0 0	.0 0	.0 0.0	0.0	0.0	ExFlr	0		
Opt Vent	0.0	0.0	0.0	0	0.0 0	0.0	.0 0.0	0.0	0.0	Roof	12,357		0 0
Totals	0.0	0.0								Wall	15,819	2,5	21 16
			ECTION		AIR	FLOWS (c	fm)	E	ENGINEERING	CHECKS	TEMPER	ATURES	(F)
	Capacit	-		Lvg	Type	Cooling	Heating	_	% OA	0.0	Type	Clg	Htg
	(Mbh)	=	-	Deg F	Vent	0	0	Clg	Cfm/Sqft	0.00	SADB	0.0	68.1
Main Htg	-1,057.		0.0	0.0	Infil	0	4,271	Clg	Cfm/Ton	0.00	Plenum	0.0	68.0
Aux Htg	0.		0.0	0.0	Supply	0	0	Clg	Sqft/Ton	0.00	Return	0.0	68.0
Preheat	0.		0.0	0.0	Mincfm	0	0	Clg	Btuh/Sqft	0.00	Ret/OA	0.0	68.0
Reheat	0.		0.0	0.0	Return	0	0	No.	People	0	Runarnd	0.0	68.0
Humidif	0.1		0.0	0.0	Exhaust	0	0	Htg	% OA	0.0	Fn MtrTD	0.0	0.0
Opt Vent	0.5 -1.057		0.0	0.0	Rm Exh	0	0	-	Cfm/SqFt	0.00	Fn BldTD		0.0
Total	-1,057.	U			Auxil	0	0	Htg	Btuh/SqFt	-42.77	Fn Frict	0.0	0.0

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Outside A	ir ==>	OA	DB/WB/HR:	0/ 0/ 0.	^				_				
•				0/ 0/ 0.	U		*	OADB:	0		OADB:	24	
•	•	Space.	Dot Aim	Ret. Air	Not	Danant	*	0	0	*			
•		Space Sens.+Lat.	Ret. Air Sensible	Latent		Percnt		Space	Percnt	•		l Peak	Percnt
•		(Btuh)	(Btuh)	(Btuh)	Total (Btuh)			Sensible	** ***	* Space :		t Sens	Of Tot
Skylite		(8141)	(Btull)	(Btuil)	(6(01)			(Btuh) O	,	* (B		(Btuh)	(%)
Skylite		0	0					=	0.00		0	0	0.00
Roof Cor		0	0		0			0	0.00	*	0	0	0.00
Glass So		0	0		0			0	0.00	_	0	0	0.00
Glass Co		0	0		0			0		*	0	0	0.00
Wall Cor		-			0			0				-3,153	12.11
		0	0		0			0		*	0	0_	0.00
Partitio		0			0			0	****			-8,589	33.00
Exposed		0			0			0		*	0	0	0.00
Infiltra		0	_		0			0	****	* -14	,289 -	14,289	54.89
Sub Tota		0	0		0	0.00	*	0	0.00	* -26	,030 -2	26,030	100.00
Internal L	Loads						*			*			
Lights		0	0		0	0.00	*	0	0.00	*	0	0	0.00
People		0			0	0.00	*	0	0.00	*	0	0	0.00
Misc		0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Tota	a (==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Lo	oad	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Ai	ir	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sup. Fan H	leat				0	0.00	*		0.00	*		0	0.00
Ret. Fan H	leat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat	Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Si	izing	0		*	0	0.00	*	0	0.00	*	0	0	0.00
Exhaust He	eat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal B	Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Tota	al==>	0	0	0	0	0.00	*	0	0.00	* * -26,	.030 -2	26,030	100.00
			COOI	ING COIL S	ELECTION	• • • • • • • • • • • • • • • • • • • •					AREAS		
	Total	Capacity		Coil Airfl		ng DB/WB,	/HR	Leaving	DB/WB/HR	Gross To		, .ass (sf	·) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)		g F Gra		eg F Deg		Floor	3,634		, (,
Main Clg	0.0	0.0	0.0	0			0.0	0.0 0.		Part	6,052		
Aux Clg	0.0	0.0	0.0	0			0.0	0.0 0.		ExFlr	0		
Opt Vent	0.0	0.0	0.0	0			0.0	0.0 0.		Roof	0		0 0
Totals	0.0	0.0								Wall	225	2	25 100
	HEATIN	G COIL SEL	ECTION		AII	RFLOWS (cfm)	****	-ENGINEERIN	G CHECKS	TEMPE	RATURES	(F)
	Capacit	y Coil A	irfl Ent	Lvg	Type	Cooling	Hea		ilg % OA	0.0	Туре	Clg	Htg
	(Mbh)	(cf	m) Deg F	Deg F	Vent	0		-	lg Cfm/Sqft		SADB	0.0	
Main Htg	-80.	2 1,	480 29.8	86.4	Infil	0			lg Cfm/Ton	0.00	Plenum	0.0	
Aux Htg	0.	-	0.0	0.0	Supply	0			lg Sqft/Ton		Return	0.0	
Preheat	0.	0	0.0	0.0	Mincfm	0		•	lg Btuh/Sqf		Ret/OA	0.0	
Reheat	0.		0.0	0.0	Return	. 0			lo. People	0.00	Runarno		
Humidif	0.		0 0.0	0.0	Exhaust	0			ltg % OA	0.0	Fn Mtrl		
	0.		0 0.0	0.0	Rm Exh	0			itg Cfm/SqFt				
Opt Vent										0.41	Fn Bldī	D 0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 2 EFFICIENT WINDOWS (CLEAR) BLDG. 143

------ BUILDING U-VALUES-----

						Roc	m U-Val	ues				Room	Room
						(Btu	ı/hr/sqt	ft/F)				Mass	Capac.
Room					Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Desc	ription	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST F	LOOR	0.124	0.000	0.000	0.000	0.000	0.310	0.318	0.265	0.000	43.8	8.75
2	2ND F	LOOR	0.124	0.000	0.000			0.310				97.1	20.31
Zone	1	Total/Ave.	0.124	0.000	0.000	0.000	0.110	0.310	0.318	0.265	0.000	70.4	14.53
System	1	Total/Ave.	0.124	0.000	0.000	0.000	0.110	0.310	0.318	0.265	0.000	70.4	14.53
3	BASEM	IENT	0.177	0.000	0.000	0.000	0.000	0.310	0.318	0.000	0.000	44.4	8.88
Zone	2	Total/Ave.	0.177	0.000	0.000	0.000	0.000	0.310	0.318	0.000	0.000	44.4	8.88
System	2	Total/Ave.	0.177	0.000	0.000	0.000	0.000	0.310	0.318	0.000	0.000	44.4	8.88
Building	g		0.146	0.000	0.000	0.000	0.110	0.310	0.318	0.265	0.000	67.1	13.81

BUILDING AREAS - ALTERNATIVE 2 EFFICIENT WINDOWS (CLEAR) BLDG. 143

BUILDING AREAS -----

Floor Total Exposed Number of Area/Dupl Floor Partition Floor Skylight Skl Net Roof Window Win Net Room Duplicate Room Area Area Area Area /Rf Area Area /Wl Number Description Fir Rm (sqft) (sqft) (sqft) (sqft) (sqft) (%) (sqft) (sqft) (%) (sqft) 1 1ST FLOOR 1 12,357 1 12,357 4,132 0 0 0 1,261 16 6,446 2 2ND FLOOR 1 12,357 12,357 4,350 0 0 0 12,357 1,261 6,852 Zone 1 Total/Ave. 24,714 8,482 0 0 0 12,357 2,521 16 13,298 System 1 Total/Ave. 24,714 8,482 0 0 12,357 2,521 16 13,298 3 BASEMENT 3,634 3,634 6,052 0 225 100 0 2 Total/Ave. 3,634 6,052 0 0 0 225 100 0 System 2 Total/Ave. 3,634 6,052 0 0 0 0 225 100 0 Building 28,348 14,534 0

12,357

2,746

13,298

System Totals

Percent	Cool	ing Loa	ad	Heati	ng Load		Cooling	Airflow		Heating	Airflor	,
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5		•	•	F (DF (_			
	0.0	0	0	-56,856	25	561	74.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-113,712	22	496	148.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-170,568	18	398	222.0	0	0	0.0	0	Q
15 - 20	0.0	0	0	-227,424	14	311	296.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-284,280	17	395	370.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-341,136	5	112	444.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-397,992	0	0	518.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-454,848	0	0	592.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-511,704	0	0	666.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-568,560	0	0	740.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-625,416	. 0	0	814.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-682,272	0	0	888.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-739,128	0	0	962.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-795,984	0	0	1,036.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-852,840	0	0	1,110.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-909,696	0	0	1,184.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-966,552	0	0	1,258.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-1,023,408	0	0	1,332.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-1,080,264	0	0	1,406.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-1,137,120	0	0	1,480.0	100	8,760	0.0	0	0
Hours Off	0.0	. 0	8,760	0	0	6,487	0.0	0	0	0.0	0	8 760

------ MONTHLY ENERGY CONSUMPTION -----

	ELEC On Peak	DEMAND On Peak	GAS On Peak	GAS DMND On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	9,908	45	1,579	5
Feb	8,921	45	1,102	5
March	9,178	45	165	3
April	7,739	43	0	0
May	8,411	43	0	0
June	8,360	43	0	0
July	7,790	43	0	0
Aug	8,721	43	0	0
Sept	7,739	43	0	0
0ct	8,411	43	0	0
Nov	8,334	45	222	3
Dec	9,598	45	1,111	4
Total	103,110	45	4,179	5

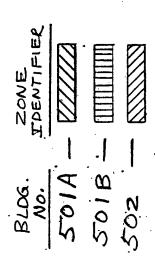
Building Energy Consumption =
Source Energy Consumption =

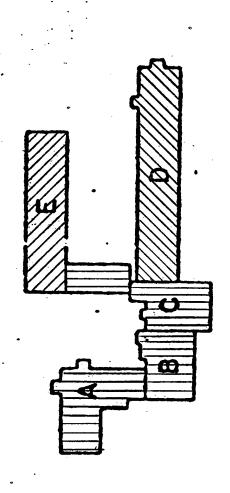
27,157 (Btu/Sq Ft/Year) 27,613 (Btu/Sq Ft/Year) Floor Area =

28,348 (Sq Ft)

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BLDG ZONE LAYOUT - P501 & P502

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TRACE 600 ANALYSIS
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ESOS STUDY AT WSMR - BUILDING 501-A WHITE SANDS MISSILE RANGE NM US ARMY EMC ENGINEERS, INC.

EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO#9)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) 106.0 (deg) Longitude: Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20 Air Density: 0.0653 (Lbm/cuft) Air Specific Heat: 0.2444 (Btu/lbm/F) Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)

Design Simulation Period: April To October System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 20: 5: 0 1/15/92

Latent Heat Factor:

4,214.8 (Btu-min./hr/cuft)

3.9171 (Lb-min./hr/cuft)

Dataset Name:

Enthalpy Factor:

501-A .TM

ammunumin

PAGE 3

System	1	Peak	INCHP	- INCREM	ENTAL HEA	T PUM	IP								
*****	*****	******	COOLING COII	PEAK ****	******	****	*****	****	**** CL6	S SPACE	PEAK ****	***** H	EATING COI	L PEAK	
Peaked a	at Time :	==>	Mo/Hr:	8/16				*	Mo	O/Hr:	7/19	*	Mo/Hr:	13/ 1	
Outside	Air ==>	Ož	ADB/WB/HR:	96/ 63/ 49	.0			*	c	DADB:	91	*	OADB:	24	
								*				*			
		Space	Ret. Air	Ret. Air		Net	Percnt	*	s	pace	Percnt	* Space	Peak Coi	Peak	Percnt
		Sens.+Lat.	Sensible	Latent	To	tal	Of Tot	*	Sens	sible	Of Tot	* Space	Sens To	Sens	Of Tot
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Bt	uh)	(%)	*	(E	Stuh)	(*)	* (B	tuh)	Btuh)	(%)
Skylit	e Solr	0	0	ı		0	0.00	*		0	0.00	k	0	0	0.00
Skylit	e Cond	0	0	ı		0	0.00	*		0	0.00	t	0	0	0.00
Roof C	Cond	14,014	0	1	14,	014	4.80	*	19	,030	7.39	-16	,227 -1	6,227	4.01
Glass	Solar	66,787	0		66,	787	22.86	*	36	,983	14.37	•	0	0	0.00
Glass	Cond	40,576	0		40,	576	13.89	*	32	,841	12.76	-107	,844 -10	7,844	26.64
Wall C	ond	66,506	0		66,	506	22.76	*	88	,122	34.23	-132	,100 -13	2,100	32.63
Partit	ion	~ o				0	0.00	*		0	0.00	t	0	ò	0.00
Expose	d Floor	0				0	0.00	*		0	0.00	-15	,048 -1	5,048	3.72
Infilt	ration	0				0	0.00	*		0	0.00	-133	,600 -13	3,600	33.00
Sub To	tal==>	187,883	0		187,	883	64.31	*	176	,977	68.74	-404	,818 -40	4,818	100.00
Internal	Loads							*				,			
Lights		42,911	0		42,5	911	14.69	*	69	,515	27.00 *	ı	0	0	0.00
People	1	14,112			14,	112	4.83	*	10	,948	4.25 *	•	0	٥	0.00
Misc		0	0	0		0	0.00	*		0	0.00 *		0	0	0.00
Sub To	tal==>	57,023	0	0	57,0	023	19.52	*	80	, 463	31.26 *	:	0	0	0.00
Ceiling	Load	0	0			0	0.00	*		0	0.00 *		0	o	0.00
Outside .	Air	0	0	0	47,2	242	16.17	*		0	0.00 *		0	0	0.00
Sup. Fan	Heat					0	0.00	*			0.00 *			o	0.00
Ret. Fan	Heat		0			0	0.00	*			0.00 *			0	0.00
Duct Hea	t Pkup		0			0	0.00	*			0.00 *			0	0.00
OV/UNDR	Sizing	0				0	0.00	*		0	0.00 *		0	0	
Exhaust			0	0		0	0.00	*			0.00 *			0	0
Terminal	Bypass		0	0		0	0.00	*			0.00 *			0	0.00
Grand To	tal==>	244,906	0	0	292.1	48 1	100.00	*	257	,440	100.00 *	-404,	818 -40	4,818	100.00
										,	200700	151,	•••	.,010	200.00
	 Motal	Capacity	COOI										AREAS		
	(Tons)	(Mbh)	Sens Cap. (Mbh)	(cfm)		-	DB/WB/I			-	3/WB/HR	Gross To		ass (sf) (%)
Main Clg	44.3	531.4	535.6	14,937	81.9	59.5	Grain 52.		60.0	Jeg F 45.2	Grains	Floor	16,764		
Aux Clg	0.0		0.0	0	0.0	0.0		.0	0.0	0.0	28.3 0.0	Part ExFlr	18,808 456		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0		.0	0.0	0.0	0.0	Roof	8,382		0 0
Totals	44.3								•••	•••	0.0	Wall	10,333	1,9	
			ECTION			AIRFL	OWS (c)	(m)-		1	ENGINEERING	CHECKS	TEMPE	RATURES	(F)
	Capaci	_		Lvg	Туре		oling	H	eating	Clo	3 % OA	21.2	Туре	Clg	Htg
	(Mbh	•	-	Deg F	Vent		3,171		0	Clo	Cfm/Sqft	0.89	SADB	60.0	96.3
Main Htg	~557	•		96.3	Infil		0		3,171		Cfm/Ton	337.33	Plenum	78.0	68.0
Aux Htg		.0	0.0	0.0	Supply	1	4,937		14,937		Sqft/Ton	378.58	Return	78.0	68.0
Preheat	-0			60.0	Mincfm		0		0		Btuh/Sqft	31.70	Ret/OA	81.9	68.0
Reheat		.0	0 0.0	0.0	Return		4,937		14,937		People	56	Runarnd	78.0	68.0
Humidif		.0	0 0.0	0.0	Exhaust		3,171		0	-	1 % OA	0.0	Fn MtrT		0.0
Opt Vent Total	-557	.0	0 0.0	0.0	Rm Exh		0		0	_	Cfm/SqFt	0.89	Fn BldT		0.0
10041	- 337	• •			Auxil		0		0	нго	g Btuh/SqFt	-33.24	Fn Fric	0.0	0.0

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 501-A

------ B U I L D I N G U - V A L U E S ------

					Roc	m U-Val	ues				Room	Room
					(Btu	/hr/sqf	t/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.358	0.000	49.0	9.80
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.044	1.140	1.259	0.358	0.000	98.5	20.59
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	1.140	1.259	0.358	0.000	73.7	15.19
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	1.140	1.259	0.358	0.000	73.7	15.19
Buildin	g	0.388	0.750	0.000	0.000	0.044	1.140	1.259	0.358	0.000	73.7	15.19

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 501-A

Room				er of icate	Floor Area/Dupl Room	Total Floor Area	Partition Area	Exposed Floor Area	Skylight Area	Skl /Rf	Net Roof	Window Area	Win /Wl	Net Wall Area
Number	Descr	iption	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(*)	(sqft)
1	1ST F	LOOR	1	1	8,382	8,382	9,595	456	0	0	0	932	18	4,339
2	2ND F	LOOR	1	1	8,382	8,382	9,213	0	0	0	8,382	1,014	20	4,047
Zone	1	Total/Ave				16,764	18,808	456	0	0	8,382	1,947	19	8,386
System	1	Total/Ave	•			16,764	18,808	456	0	0	8,382	1,947	19	8,386
Buildin	g					16,764	18,808	456	0	0.	8,382	1,947	19	8,386

System Totals

Percent	Cool	ing Loa	ıd	Heatir	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	2.2	12	337	-27,864	9	148	746.8	0	0	0.0	0	0
5 - 10	4.4	8	223	-55,728	14	249	1,493.7	0	0	0.0	0	0
10 - 15	6.6	11	298	-83,592	7	113	2,240.5	0	0	0.0	- 0	0
15 - 20	8.9	8	224	-111,456	8	136	2,987.4	0	0	0.0	0	0
20 - 25	11.1	10	273	-139,320	10	173	3,734.2	0	0	0.0	0	0
25 - 30	13.3	11	299	-167,184	13	231	4,481.1	0	0	0.0	0	0_
30 - 35	15.5	12	346	-195,048	14	239	5,227.9	0	0	0.0	0	0
35 - 40	17.7	8	236	-222,912	13	224	5,974.8	0	0	0.0	0	0
40 - 45	19.9	6	177	-250,776	7	117	6,721.6	0	0	0.0	0	0
45 - 50	22.1	12	324	-278,640	5	79	7,468.5	0	0	0.0	0	0
50 - 55	24.4	1	40	-306,504	1	10	8,215.3	0	0	0.0	0	0
55 - 60	26.6	0	0	-334,368	0	0	8,962.2	0	0	0.0	0	0
60 - 65	28.8	0	0	-362,232	0	0	9,709.0	0	0	0.0	0	0
65 - 70	31.0	0	0	-390,096	0	0	10,455.9	0	0	0.0	0	0
70 - 75	33.2	0	0	-417,960	0	0	11,202.7	0	0	0.0	0	0
75 ~ 80	35.4	0	0	-445,824	0	0	11,949.6	0	0	0.0	0	0
80 - 85	37.6	0	0	-473,688	0	0	12,696.4	0	0	0.0	0	0
85 - 90	39.9	0	0	-501,552	0	0	13,443.3	0	0	0.0	0	0
90 - 95	42.1	0	0	-529,416	0	0	14,190.1	0	0	0.0	0	0
95 - 100	44.3	0	0	-557,280	0	0	14,937.0	100	8,760	0.0	Ó	0
Hours Off	0.0	0	5,983	o	0	7,041	0.0	0	0	0.0	0	8,760

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 М	o	N	т	н	L	Y	E	: N	E	: 1	R	G	Y	С	0	N	s	U	М	P	т	T	0	N	_

	ELEC	DEMAND
	On Peak	On Peak
Month	(kWh)	(kW)
Jan	30,267	108
Feb	23,697	106
March	7,583	60
April	5,834	26
May	11,315	52
June	17,085	61
July	18,845	62
Aug	18,359	61
Sept	11,840	53
Oct	6,960	44
Nov	7,608	57
Dec	19,298	86
Total	178,690	108

Building Energy Consumption =

36,381 (Btu/Sq Ft/Year)

Floor Area =

16,764 (Sq Ft)

Source Energy Consumption =

36,381 (Btu/Sq Ft/Year)

E monthly peak demand = 776

ESOS STUDY AT WSMR - BUILDING 501-A
WHITE SANDS MISSILE RANGE NM
US ARMY

EMC ENGINEERS, INC.

EFFICIENT WINDOWS: ALT 1-BSLN, ALTZ-ECO (CLEAR) (ECO #9)

Weather File Code: ELPASO.W Location: 31.0 (deg) Latitude: Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: April To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 3:13: 9 1/18/92
Dataset Name: 501-A .TM

D3-123

0

-314,897

0.00

100.00

				DLING COIL SE	ELECTION							AR	EAS	
	Total	Capacity	Sens Cap.	Coil Airfl	Ent	ering D	B/WB/HR	Lea	ving DB	/WB/HR	Gross	Total	Glass (sf)	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F	Deg F	Grains	Deg F	Deg F	Grains	Floor	16.764		• • • • • • • • • • • • • • • • • • • •
Main Clg	44.3	531.4	536.2	13,715	81.8	59.5	52.7	60.0	43.7	23.2	Part	18,808		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	456		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	8.382	ſ	0
Totals	44.3	531.4									Wall	10,333	1,947	•

0.00

0.00

0.00

0.00

100.00 *

-314,897

236,382

0

0

264,129 100.00 *

0

0

0

0

HEATING COIL SELECTION					/	AIRFLOWS (cf	m)	ENGINEERING	CHECKS	TEMPERA	TURES	(F)
	Capacity	Coil Airfl	Ent	Lvg	Type	Cooling	Heating	Clg % OA	21.5	Type	Clg	Htg
	(Mbh)	(cfm)	Deg F	Deg F	Vent	2,949	0	Clg Cfm/Sqft	0.82	SADB	60.0	92.0
Main Htg	-557.3	13,715	49.5	92.0	Infil	0	2,949	Clg Cfm/Ton	309.74	Plenum	78.0	68.0
Aux Htg	0.0	0	0.0	0.0	Supply	13,715	13,715	Clg Sqft/Ton	378.58	Return	78.0	68.0
Preheat	-0.0	13,715	58.5	60.0	Mincfm	0	0	Clg Btuh/Saft	31.70	Ret/OA	81.8	68.0
Reheat	0.0	0	0.0	0.0	Return	13,715	13,715	No. People	56	Runarnd	78.0	68.0
Humidif	0.0	. 0	0.0	0.0	Exhaust	2,949	0	Htg % OA	0.0	Fn MtrTD	0.0	0.0
Opt Vent	0.0	0	0.0	0.0	Rm Exh	0	0	Htg Cfm/SqFt	0.82	Fn BldTD	0.0	0.0
Total	-557.3				Auxil	0	0	Htg Btuh/SqFt	-33.24	Fn Frict	0.0	0.0

interior in the

Terminal Bypass

Grand Total ==>

223,228

BUILDING U-VALUES - ALTERNATIVE 2 EFFICIENT WINDOWS (CLEAR) BLDG 501-A

------ BUILDING U-VALUES-----

												Room	Room	
_	• • •								Mass	Capac.				
Room					Summr	Wintr		Summr	Wintr			(lb/	(Btu/	
Number	Desc	ription	Part.	Exflr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)	
1	1ST F	LOOR	0.388	0.750	0.000	0.000	0.000	0.310	0.318	0.358	0.000	49.0	9.80	
2	2ND F	LOOR	0.388	0.000	0.000	0.000	0.044	0.310	0.318	0.358	0.000	98.5	20.59	
Zone	1	Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	<i>7</i> 3.7	15.19	
System	1	Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	73.7	15.19	
Building	g		0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	73.7	15.19	

BUILDING AREAS - ALTERNATIVE 2
EFFICIENT WINDOWS (CLEAR) BLDG 501-A

BUILDING AREAS

Room Number	Des	cription		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	/Rf	Net Roof Area (sqft)	Window Area (sqft)	Win /WL (%)	Net Wall Area (sqft)
1	151	FLOOR	1	1	8,382	8,382	9,595	456	0	0	0	932	18	4,339
2	2ND	FLOOR	1	1	8,382	8,382	9,213	0	.0	0	8,382	1,014	20	4,047
Zone		1 Total/Ave.				16,764	18,808	456	0	0	8,382	1,947	19	8.386
System		1 Total/Ave.	•			16,764	18,808	456	0	0	8,382	1,947	19	8,386
Buildin	g					16,764	18,808	456	0	0	8,382	1,947	19	8,386

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

System Totals

Percent	Cooling Load Heating Load		Cooling Load		Cooling	Airflo		Keating	Airflow			
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	2.2	11	313	-27,864	11	166	685.8	0	0	0.0	0	0
5 - 10	4.4	8	237	-55,728	13	197	1,371.5	0	0	0.0	0	0
10 - 15	6.6	12	359	-83,592	9	134	2,057.3	0	0	0.0	0	0
15 - 20	8.9	10	285	-111,456	8	132	2,743.0	0	0	0.0	0	o o
20 - 25	11.1	10	288	-139,320	13	201	3,428.8	0	0	0.0	0	0
25 - 30	13.3	14	394	-167,184	11	170	4,114.5	0	. 0	0.0	0	0
30 - 35	15.5	11	317	-195,048	15	229	4,800.3	0	0	0.0	0	0
35 - 40	17.7	10	296	-222,912	12	181	5,486.1	0	0	0.0	0	0
40 - 45	19.9	11	327	-250,776	7	109	6,171.8	0	0	0.0	0	0
45 - 50	22.1	3	83	-278,640	3	39	6,857.6	0	0	0.0	0	0
50 - 55	24.4	0	0	-306,504	0	0	7,543.3	0	0	0.0	0	0
55 - 60	26.6	0	0	-334,368	0	0	8,229.1	0	0	0.0	0	0
60 - 65	28.8	0	0	-362,232	0	0	8,914.9	0	0	0.0	0	0
65 - 70	31.0	0	0	-390,096	0	0	9,600.6	0	0	0.0	0	0
70 - 75	33.2	0	0	-417,960	0	0	10,286.4	0	0	0.0	0	0
75 - 80	35.4	0	0	-445,824	0	0	10,972.1	0	0	0.0	0	0
80 - 85	37.6	. 0	0	-473,688	0	0	11,657.9	0	0	0.0	0	0
85 - 90	39.9	0	0	-501,552	0	0	12,343.6	0	0	0.0	0	0
90 - 95	42.1	0	0	-529,416	0	0	13,029.4	0	0	0.0	0	0
95 - 100	44.3	0	0	-557,280	0	0	13,715.2	100	8,760	0.0	0	0
Hours Off	0.0	0	5,861	0	0	7,202	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

•		
MONTHLY	ENERGY	CONSUMPTION

	ELEC	DEMAND			
	On Peak	On Peak			
Month	(kWh)	(kV)			
Jan	27,298	86			
Feb	20,766	85			
March	7,360	56			
April	5,834	31			
May	11,503	51			
June	16,527	58	4		
July	18,095	59			
Aug	18,076	58			
Sept	12,100	52			
0ct	7,204	45			
Nov	7,323	55			
Dec	16,961	68			
Total	169,048	86			
Building Ener	gy Consumption		7 (Btu/Sq Ft/Year)	Floor Area =	16,764 (Sq
Source Energy		-	7 (Btu/Sq Ft/Year)		• • • • • • • • • • • • • • • • • • • •

Emonthly KW= 704

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      TRACE 600
             ANALYSIS
      by
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ESOS STUDY AT WSMR - BUILDING 501-A WHITE SANDS MISSILE RANGE NM US ARMY

EMC ENGINEERS, INC.

EMC ENGINEERS, INC.

EFFICIENT WINDOWS: ALT 1-BSLN, ALTE-ECO (CREY) (ECO*9)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 3,918 (ft) Elevation: Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F)

Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft) Air Specific Heat: 0.2444 (Btu/lbm/F) Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft) Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: April To October System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 3:32:57 1/18/92

Dataset Name: 501-A .TM

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

Peak

System

INCHP

Mo/Hr: 13/ 1 Mo/Hr: 7/19 Mo/Hr: 7/16 Peaked at Time ==> OADB: 91 CADB: 24 Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 Percnt * Space Peak Coil Peak Percnt Ret. Air Ret. Air Net Percnt Space Space Total Of Tot Sensible Of Tot Space Sens Tot Sens Sens.+Lat. Sensible Latent (Btuh) (Btuh) (%) (Btuh) (%) (Btuh) (%) Envelope Loads (Btuh) (Btuh) 0 0 0.00 0.00 0 0.00 Skylite Solr 0 0 0 0 0 0.00 Skylite Cond 0 0 0 0.00 0 0.00 5.15 Roof Cond 16,301 0 16,301 6.88 19,030 8.58 -16,227 -16,227 25,304 11.41 0 0 0.00 Glass Solar 36,902 0 36,902 15.57 -27,274 11,368 4.80 8.931 4.03 -27,274 8.66 Glass Cond 11,368 0 -132,100 88,122 -132,100 41.95 30.39 39.72 * Wall Cond 72,043 n 72,043 0.00 0 0 0.00 Partition n O 0.00 0 0 0 0.00 0 0.00 -15,048 -15,048 4.78 Exposed Floor 0.00 * 0.00 -124,248 -124,248 39.46 Infiltration 0 Λ n 63.73 * -314,897 -314,897 100.00 Sub Total==> 136,614 0 136,614 57.64 141,387 Internal Loads 42,911 42,911 18.10 * 69,515 31.33 0 0 0.00 Lights 0 5.95 * 4.93 0 0 0.00 14,112 14,112 10,948 People n 0.00 0.00 * 0 0.00 n Misc n 0 0 0 24.06 * 0 0.00 Sub Total ==> 57,023 0 0 57,023 80,463 36.27 n 0 0.00 * 0 0.00 n O 0.00 Ceiling Load 0 18.31 * 0.00 0.00 Outside Air 0 43,393 0.00 0.00 0.00 0 Sup. Fan Heat n 0.00 0.00 0 0.00 O Ret. Fan Heat 0.00 0.00 n 0.00 Duct Heat Pkup 0 O OV/UNDR Sizing 0 0.00 0.00 0 0 0.00 Exhaust Heat 0 Û 0 0.00 0 0.00 0.00 Û 0.00 Terminal Bypass 0 0 0 237,029 100.00 * 100.00 * -314,897 Grand Total==> 193,637 0 221,850 -314.897 100.00 -----COOLING COIL SELECTION----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR **Gross Total** Glass (sf) (%) (Mbh) Deg F Deg F Grains 16,764 (Tons) (Mbh) (cfm) Deg F Deg F Grains Floor Main Clg 44.3 531.4 537.3 12,872 82.3 59.6 52.7 60.0 42.7 19.8 Part 18,808 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 456 8,382 0 0 Opt Vent 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 44.3 531.4 Wall 10,333 1,947 19 Totals ------HEATING COIL SELECTION----------AIRFLOWS (cfm)-------- ENGINEERING CHECKS----TEMPERATURES (F) ---Capacity Coil Airfl Cooling Heating Clg % OA 22.9 Clg Ent Lvg Type Type Clg Cfm/Sqft 93.5 (Mbh) (cfm) Deg F Deg F Vent 2,949 SADB Main Htg -557.3 12,872 48.3 93.5 0 2,949 Clg Cfm/Ton 290.70 Plenum 78.0 68.0 Infil 12,872 0.0 0.0 12,872 378.58 78.0 68.0 Aux Hta 0 0.0 Clg Sqft/Ton Return Supply 31.70 Preheat -0.0 12,872 57.9 60.0 Mincfm 0 0 Clg Btuh/Sqft Ret/OA 82.3 68.0 Reheat 0.0 0 0.0 0.0 12,872 12,872 No. People 56 Runarnd 78.0 68.0 Return 0.0 2,949 0 0.0 Humidif 0 0.0 0.0 Exhaust Htg % OA Fn MtrTD 0.0 0.0 Opt Vent 0.0 0.0 0.0 0 0 Htg Cfm/SqFt 0.77 Fn BldTD 0.0 0.0 Rm Exh -557.3 0 Total Htg Btuh/SqFt -33.24 fn Frict 0.0 0.0 Auxil

- INCREMENTAL HEAT PUMP

BUILDING U-VALUES - ALTERNATIVE 3
EFFICIENT WINDOWS (GREY) BLDG 501-A

BUILDING U-VALUES-----

				Room U-Values									
	(Btu/hr/sqft/F)									Mass	Capac.		
Room					Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Desc	ription	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST F	LOOR	0.388	0.750	0.000	0.000	0.000	0.310	0.318	0.358	0.000	49.0	9.80
2	2ND F	LOOR	0.388	0.000	0.000	0.000	0.044	0.310	0.318	0.358	0.000	98.5	20.59
Zone	1	Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	73.7	15.19
System	1	Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	73.7	15.19
Building	g		0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	73.7	15.19

BUILDING AREAS - ALTERNATIVE 3
EFFICIENT WINDOWS (GREY) BLDG 501-A

Room Number	Des	cription		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	/Rf	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	151	FLOOR	1	1	8,382	8,382	9,595	456	0	0	0	932	18	4,339
2	2ND	FLOOR	1	1	8,382	8,382	9,213	0	0	0	8,382	1,014	20	4,047
Zone		1 Total/Ave				16,764	18,808	456	0	0	8,382	1,947	19	8,386
System		1 Total/Ave				16,764	18,808	456	0	0	8,382	1,947	19	8,386
Buildin	g					16,764	18,808	456	0	0	8,382	1,947	19	8,386

System Totals

Percent	Cool	ling Loa	ad	Heating Load		Cooling	Airflo		Heating	Heating Airflow			
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours	
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)		
0 - 5	2.2	11	313	-27,864	13	218	643.6	0	0	0.0	0	0	
5 - 10	4.4	10	300	-55 <i>,7</i> 28	11	182	1,287.2	0	0	0.0	0	0	
10 - 15	6.6	13	361	-83,592	9	150	1,930.8	0	0	0.0	0	0	
15 - 20	8.9	10	285	-111,456	7	127	2,574.4	0	0	0.0	0	٥	
20 - 25	11.1	11	311	-139,320	13	221	3,218.0	0	0	0.0	0	0	
25 - 30	13.3	13	370	-167,184	11	179	3,861.6	0	0	0.0	0	0	
30 - 35	15.5	13	369	-195,048	17	280	4,505.2	0	0	0.0	0	0	
35 - 40	17.7	7	214	-222,912	11	181	5,148.8	0	0	0.0	0	0	
40 - 45	19.9	11	305	-250,776	7	118	5,792.4	0	0	0.0	0	0	
45 - 50	22.1	1	40	-278,640	2	39	6,436.0	0	0	0.0	0	0	
50 - 55	24.4	0	0	-306,504	0	0	7,079.6	0	0	0.0	0	0	
55 - 60	26.6	0	0	-334,368	0	0	7,723.2	- 6	0	0.0	0	0	
60 - 65	28.8	0	0	-362,232	0	0	8,366.8	0	0	0.0	0	0	
65 - 70	31.0	0	0	-390,096	0	0	9,010.4	0	0	0.0	0	0	
70 - 75	33.2	0	0	-417,960	0	0	9,654.0	0	0	0.0	0	0	
75 - 80	35.4	0	0	-445,824	0	0	10,297.6	0	0	0.0	0	0	
80 - 85	37.6	0	0	-473,688	0	0	10,941.2	0	0	0.0	0	0	
85 - 90	39.9	0	0	-501,552	0	0	11,584.8	0	0	0.0	0	0	
90 - 95	42.1	0	0	-529,416	0	0	12,228.4	0	0	0.0	0	0	
95 - 100	44.3	0	0	-557,280	0	0	12,872.0	100	8,760	0.0	0	0	
Hours Off	0.0	0	5,892	0	0	7,065	0.0	0	. 0	0.0	0	8,760	

------ MONTHLY ENERGY CONSUMPTION -----

	ELEC	DEMAND
	On Peak	On Peak
Month	(kWh)	(kW)
Jan	28,547	86
Feb	21,818	85
March	7,450	56
April	5,834	26
May	11,249	49
June	15,939	56
July	17,487	57
Aug	17,419	56
Sept	11,423	50
Oct	7,059	43
Nov	7,439	55
Dec	17,948	68
Total	169,612	86

Building Energy Consumption =

34,532 (Btu/Sq Ft/Year)

Floor Area =

16,764 (Sq Ft)

Source Energy Consumption = 34,532 (Btu/Sq Ft/Year)

ESOS STUDY AT WSMR - BUILDING 501-A
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALTZ-ECO (Bronze) (ECO #9)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F)

Summer Ground Relectance:

Winter Ground Relectance:

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

0.20

0.20

Design Simulation Period: April To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 3:50:31 1/18/92
Dataset Name: 501-A .TM

Peak

INCHP

- INCREMENTAL HEAT PUMP

System

sisting the state of

	*******		Ma/U	7/14			-		. 111.0	7/10			47.	
Peaked a				7/16	_		*		/Hr:		*	Mo/Hr:		
Outside	A17 ==>	U	WB/WB/HR:	97/ 64/ 49.	U		*	C	ADB:	91	•	OADB:	24	
		Space	Ret. Air	Ret. Air	Ne	et Pero	cnt *	s	pace	Percnt 1	* Space !	Peak Coil	Peak	Percr
		Sens.+Lat.	Sensible	Latent	Tota				ible	Of Tot	•		Sens	Of To
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh	n) (r	(%) *		tuh)	(%)			(Btuh)	(2
Skylit	e Solr	0	0			0 0.	.00 *	-	Ó	0.00		0	0	0.0
Skylit	e Cond	0	0				.00 *		0	0.00	•	0	0	0.0
Roof C	ond	16,301	0		16,30	01 6.	.88 *	19	,030	8.58	-16	,227 -1	6,227	5.1
Glass	Solar	36,902	0		36,90		.57 *		,304	11.41		0	0	0.0
Glass	Cond	11,368	0		11,36		.80 *		,931	4.03		,274 -2	7,274	8.6
Wall C	ond	72,043	0		72,04		.39 *		, 122	39.72			2,100	41.9
Partit	ion	0			•		.00 *		0	0.00		0	0	0.0
Expose	d Floor	0					.00 *		0	0.00			5,048	4.7
	ration	0					.00 *		0	0.00		•	4,248	39.4
	tal==>	136,614	0		136,61		.64 *	141	,387	63.73 1	•		4,897	100.0
Internal		,	·		.55,61		*		,,,,,,	03.73	. J.4,	,0,,	4,071	100.0
Lights		42,911	0		42,91	11 18	.10 *	60	,515	31.33	,	0	0	0.0
People		14,112	_		14,11		95 *		,948	4.93		0	0	0.0
Misc		0	0	0	-		.00 *		0	0.00		0	0	0.0
Sub To	tal==>	57,023	0	•	57,02		.06 *	80	,463	36.27 1		0	0	0.0
Ceiling		0	0	•	•		.00 *	-	0	0.00		0	0	0.0
Outside .		0	0	0	43,39		.31 *		0	0.00		0	0	0.0
Sup. Fan			-	•	•		.00 *		•	0.00		•	0	0.0
Ret. Fan			0				.00 *			0.00			0	0.0
Duct Hea			0				.00 *			0.00			0	0.0
OV/UNDR	•	0					00 *		0	0.00		0	0	0.0
Exhaust	-		0	0			00 *		•	0.00		·	0	
Terminal			0	0			.00 *			0.00			0	0.0
							*			1	,		ŭ	0.0
Grand To	tal==>	193,637	0	0	237,02	9 100.	00 *	221	,850	100.00	-314,	.897 -31	4,897	100.0
	•		C00I	ING COIL S	ELECTION							·AREAS		*****
	Total	Capacity	Sens Cap.	Coil Airfl	Enter	ing DB/	WB/HR	Lea	ving D	B/WB/HR	Gross To	tal Gl	ass (st	f) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F D	eg F G	rains	Deg F	Deg F	Grains	Floor	16,764		
ain Clg	44.3	531.4	537.3	12,872	82.3	59.6	52.7	60.0	42.7	19.8	Part	18,808		
ux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Exflr	456		
pt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	8,382		0 (
otals	44.3	531.4									Wall	10,333	1,9	947 19
	HEATI	NG COIL SEL	ECTION		A	IRFLOWS	(cfm)			ENGINEERING	CHECKS	TEMPE	RATURES	S (F)
	Capaci	ty Coil A	irfl Ent	Lvg	Type	Cooli	ng	Heating	Cl	g % OA	22.9	Type	Clg	
	(Mbh) (cfi	n) Deg F	Deg F	Vent	2,9	49	0	Cl	g Cfm/Sqft	0.77	SADB	60.0	_
ain Ktg	-557	.3 12,	872 48.3	93.5	Infil		0	2,949	Cl	g Cfm/Ton	290.70	Plenum	78.0	
ux Htg	0	.0	0.0	0.0	Supply	12,8	72	12,872		g Sqft/Ton	378.58	Return	78.0	
reheat	-0	.0 12,8	B72 57.9	60.0	Mincfm		0	0	cı	g Btuh/Sqft		Ret/OA	82.3	
eheat	0	.0	0.0	0.0	Return	12,8	72	12,872	No	. People	56	Runarnd		
umidif	. 0	.0	0.0	0.0	Exhaust	2,9	49	0		g % OA	0.0	Fn MtrT		
pt Vent	0.	.0	0.0	0.0	Rm Exh		0	0		g Cfm/SqFt		Fn BldT		
otal	-557	7			Auxil		0	0		g Btuh/SqFt		Fn Fric		0.0

BUILDING U-VALUES - ALTERNATIVE 4
EFFICIENT WINDOWS (BRONZE) BLDG 501-A

----- BUILDING U-VALUES------

		Room U-Values									Room	Room
					(Btu	/hr/sqf	t/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	0.310	0.318	0.358	0.000	49.0	9.80
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.044	0.310	0.318	0.358	0.000	98.5	20.59
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	73.7	15.19
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	73.7	15.19
Buildin	g	0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	73.7	15.19

BUILDING AREAS - ALTERNATIVE 4
EFFICIENT WINDOWS (BRONZE) BLDG 501-A

					Floor	Total		Exposed						
			Numbe	er of	Area/Dupl	Floor	Partition	Floor	Skylight	Skl	Net Roof	Window	Win	Net Wall
Room			Dupl	icate	Room	Area	Area	Area	Area	/Rf	Area	Area	/Wl	Area
Number	Des	cription	Flr	Rm .	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	151	FLOOR	1	1	8,382	8,382	9,595	456	0	0	0	932	18	4,339
2	2ND	FLOOR	1	1	8,382	8,382	9,213	0	0	0	8,382	1,014	20	4,047
Zone		1 Total/Av	e.			16,764	18,808	456	0	0	8,382	1,947	19	8,386
System		1 Total/Av	e.			16,764	18,808	456	0	0	8,382	1,947	19	8,386
Bui ldi	ng					16,764	18,808	456	0	0	8,382	1,947	19	8,386

System Totals

Percent	Cool	ing Loa	ad	Heati	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	2.2	11	313	-27,864	13	218	643.6	0	0	0.0	0	0
5 - 10	4.4	10	300	-55,728	11	182	1,287.2	0	0	0.0	0	0
10 - 15	6.6	13	361	-83,592	9	150	1,930.8	0	0	0.0	0	0
15 - 20	8.9	10	285	-111,456	7	127	2,574.4	0	0	0.0	0	Õ
20 - 25	11.1	11	311	-139,320	13	221	3,218.0	0	0	0.0	0	0
25 - 30	13.3	13	370	-167,184	11	179	3,861.6	0	0	0.0	0	0
30 - 35	15.5	13	369	-195,048	17	280	4,505.2	0	0	0.0	0	0
35 - 40	17.7	7	214	-222,912	11	181	5,148.8	0	0	0.0	0	0
40 - 45	19.9	11	305	-250,776	7	118	5,792.4	0	0	0.0	0	0
45 - 50	22.1	1	40	-278,640	2	39	6,436.0	0	0	0.0	0	0
50 - 55	24.4	0	0	-306,504	0	0	7,079.6	0	0 -	0.0	0	0
55 - 60	26.6	0	0	-334,368	0	0	7,723.2	0	0	0.0	0	0
60 - 65	28.8	0	0	-362,232	0	0	8,366.8	0	0	0.0	0	0
65 - 70	31.0	0	0	-390,096	0	0	9,010.4	0	0	0.0	0	0
70 - 75	33.2	0	0	-417,960	0	0	9,654.0	0	0	0.0	0	0
75 - 80	35.4	0	0	-445,824	0	0	10,297.6	0	0	0.0	0	0
80 - 85	37.6	0	0	-473,688	. 0	0	10,941.2	0	0	0.0	0	0
85 - 90	39.9	0	0	-501,552	0	0	11,584.8	0	0	0.0	0	0
90 - 95	42.1	0	0	-529,416	0	0	12,228.4	0	0	0.0	0	0
95 - 100	44.3	0	0	-557,280	0	0	12,872.0	100	8,760	0.0	0	0
Hours Off	0.0	0	5,892	0	0	7,065	0.0	0	0	0.0	0	8,760

discourance

------ MONTHLY ENERGY CONSUMPTION ------

On Donk On Dool	
On Peak On Peal	
Month (kWh) (kW))
Jan 28,547 86	5
Feb 21,818 85	;
March 7,450 56	,
April 5,834 26	•
May 11,249 49	•
June 15,939 56	•
July 17,487 57	•
Aug 17,419 56	•
Sept 11,423 50)
Oct 7,059 43	;
Nov 7,439 55	;
Dec 17,948 68	3
Total 169,612 86	

Building Energy Consumption = Source Energy Consumption =

34,532 (Btu/Sq Ft/Year) 34,532 (Btu/Sq Ft/Year) Floor Area = 16,764 (Sq Ft)

Z monthly peak demiand = GB7 KW

1

************************ TRACE 600 ANALYSIS ** *****************

ESOS STUDY AT WSMR - BUILDING 501-B WHITE SANDS MISSILE RANGE NM US ARMY EMC ENGINEERS, INC.

EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO#9)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft) Air Specific Heat: 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft) Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 1/20/92 13:25:44 Dataset Name:

501-B .TM

and books and in

Fn Frict

0.0

0.0

System Block RAD - RADIATION Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: 0 OAD8: 24 Net Percnt * Space Ret. Air Ret. Air Percnt * Space Space Peak Coil Peak Percnt Sens.+Lat. Sensible Latent Total Of Tot * Of Tot * Sensible Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (%) * (Btuh) (Btuh) (Btuh) (%) Skylite Solr 0 0 0.00 * 0 ۵ 0.00 * 0 a 0.00 Skylite Cond 0 0 0 0.00 * 0.00 * 0 0 0 0.00 Roof Cond 0 0 0 0.00 * 0 0.00 * -23,503 -23,503 5.01 Glass Solar 0 0 0 0.00 * n 0.00 * 0 0 0.00 Glass Cond 0 0 0 0.00 * 0.00 * n -153,914 -153,914 32.79 Wall Cond 0 0 0 0.00 * 0.00 * -147,589 -147,589 31.44 Partition O 0 0.00 * 0 0.00 * Ω 0 0.00 Exposed Floor 0 0 0.00 * 0.00 * n -6,347 -6,347 1.35 Infiltration 0.00 * n 0 0.00 * -138,051 -138,051 29.41 Sub Total ==> 0 Ω 0 0.00 * 0.00 * 0 -469,404 -469,404 100.00 Internal Loads Lights 0 0 0 0.00 * 0.00 * n 0 0.00 People 0 0.00 * n 0.00 * 0 0 0.00 Misc 0 n 0.00 * n Ω 0.00 * 0 0.00 Sub Total==> n 0 O 0.00 * 0.00 * 0 0 0.00 Ceiling Load Ω 0.00 * 0 0.00 * 0 0 0.00 Outside Air 0 0.00 * n 0.00 * 0 0.00 Sup. Fan Heat 0.00 * Ω 0.00 * 0 0.00 Ret. Fan Heat 0 0.00 * 0.00 0 0.00 Duct Heat Pkup O 0 0.00 * 0.00 0 0_0 OV/UNDR Sizing 0 0.00 * 0.00 0 0 Exhaust Neat 0 0 0.00 0.00 * 0 Terminal Bypass 0.00 0.00 0.00 Grand Total==> 0 n 0 0.00 * 0.00 * -469,404 -469,404 100.00 -----COOLING COIL SELECTION------------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 17,165 Main Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Part 8,622 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Exflr 192 Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 12,140 Totals 0.0 0.0 Wall 12,148 2,778 23 ------HEATING COIL SELECTION-----------AIRFLOWS (cfm)-------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Type Cooling Heating Clg % OA 0.0 Type Clg Hta (Mbh) (cfm) Deg F Deg F Vent 0 0 Clg Cfm/Sqft 0.00 SADB 0.0 68.1 Main Htg -666.8 0 0.0 0.0 Infil 0 3,277 Clg Cfm/Ton 0.00 Plenum 0.0 68.0 Aux Htg 0.0 0 0.0 0.0 Supply 0 0 Clg Sqft/Ton 0.00 Return 0.0 68 n Preheat 0.0 0 0.0 0.0 Mincfm 0 0 Clg Btuh/Saft 0.00 Ret/OA 0.0 68.0 Reheat 0.0 0 0.0 0.0 Return 0 0 No. People 0 Runarnd 0.0 68.0 Humidif 0.0 0 0.0 0.0 Exhaust 0 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0 0.0 0.0 Rm Exh Ω 0 Htg Cfm/SqFt 0.00 Fn BldTD 0.0 0.0 Total -666.8 Auxil 0 Htg Btuh/SqFt -38.84

Opt Vent

0.0

Total

ı

0.00 Fn BidTD 0.1

0.00 Fn Frict 0.2 0.0

0.0

O Htg Cfm/SqFt

O Htg Btuh/SqFt

System	2	Peak	PTAC	- PACKAGE	D TERMINAL	AIR COND.							
*****	*****	******	COOLING COIL	PEAK ****	*****	*****	***** CLG	SPACE	PEAK ****	***** HEA	TING COIL	PEAK **	*****
Peaked a	t Time =	:=>	Mo/Hr:	8/16			* Mc	/Hr:	9/17 *		Mo/Hr: (0/0	
Outside	Air ==>	OA	DB/WB/HR:	96/ 63/ 49.	0		* 0	ADB:	86 *		OADB:	0	
							*		*				
		Space	Ret. Air	Ret. Air	Net	Percnt	* 5	pace	Percnt *	Space Pe	ak Coili	Peak	Percnt
		Sens.+Lat.	Sensible	Latent	Total	Of Tot	* Sens	ible	Of Tot *	Space Se	ns Tot	Sens	Of Tot
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	* (8	tuh)	(%) *	(Btu	h) (B	tuh)	(%)
Skylit	e Solr	0	0		0	0.00	*	0	0.00 *		0	0	0.00
Skylit	e Cond	0	0		0	0.00	*	0	0.00 *		0	0	0.00
Roof C	ond	409	0		409	1.82	*	346	1.62 *		0	0	0.00
Glass	Solar	11,151	0		11,151	49.55	* 16	,254	76.13 *		0	0	0.00
Glass	Cond	3,749	. 0		3,749	16.66	* 1	,831	8.58 *		0	0	0.00
Wall C	ond	1,377	0		1,377	6.12	* 1	,592	7.46 *		0	0_	0.00
Partit	ion	0			0	0.00	*	0	0.00 *		0	0	0.00
Expose	d Floor	0			0	0.00	*	0	0.00 *		0	0	0.00
Infilt	ration	0			0	0.00	*	0	0.00 *		0	0	0.00
Sub To	tal==>	16,686	0		16,686	74.15	* 20	,024	93.78 *		0	0	0.00
Internal	Loads						*		*				
Lights	;	1,393	0		1,393	6.19	*	738	3.46 *		0	0	0.00
People	:	1,680			1,680	7.47	*	589	2.76 *		0	0	0.00
Misc		0	0	0	0	0.00	*	0	0.00 *		0	0	0.00
Sub To	tal==>	3,073	0	0	3,073	13.65	* 1	,327	6.22 *		0	0	0.00
Ceiling	Load	0	0		. 0	0.00	*	0	0.00 *		0	0	0.00
Outside	Air	0	0	0	2,461	10.93	*	0	0.00 *		0	0	0.00
Sup. Fan					284		*		0.00 *			0	0.00
Ret. Fan	Heat		0		0	0.00	*		0.00 *			0	0.00
Duct Hea	t Pkup		0		C	0.00	*		0.00 *			0	0.00
OV/UNDR	Sizing	0			0		*	0	0.00 *		0	0	0.00
Exhaust	Heat		0	0	C		*		0.00 *			0	0.00
Terminal	Bypass		0	0	0		*		0.00 *			0	0.00
							*		*			_	****
Grand To	tal==>	19,759	0	0	22,504	100.00	* 21	,351	100.00 *		0	0	0.00
			coo	LING COIL S	ELECTION						AREAS-		
	Total	Capacity	Sens Cap.	Coil Airfl	Enteri	ing DB/WB/	HR Lea	ving D	B/WB/HR	Gross Tot	al Glas	ss (sf)	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	g F Grai	ns Deg F	Deg F	Grains	Floor	272		
Main Clg	2.0	24.0	22.9	800	81.0 5	7.8 46	.0 49.9	45.4	45.3	Part	355		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0 0	.0 . 0.0	0.0	0.0	Exflr	0		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0 0	.0 0.0	0.0	0.0	Roof	272		0 0
Totals	2.0	24.0								Wall	366	18	9 52
	HEATI	NG COIL SEL	ECTION		AI	RFLOWS (c	fm)		ENGINEERING	CHECKS	TEMPER/	ATURES	(F)
	Capaci	ty Coil A	irfl Ent	Lvg	Type	Cooling	Heating	Cl	g % OA	16.3	Туре	Clg	Htg
	(Mbh	ı) (cf	m) Deg F	Deg F	Vent	130	O	ct.	g Cfm/Sqft	2.94	SADB	50.1	0.0
Main Htg	-0	.0	0 0.0	0.0	Infil	0	0		g Cfm/Ton	400.00	Plenum	78.0	0.0
Aux Htg	C	0.0	0 0.0	0.0	Supply	800	0		g Sqft/Ton	136.03	Return	78.0	0.0
Preheat	-0	0.0	800 3.9	49.8	Mincfm	0	0		g Btuh/Sqft		Ret/OA	80.9	0.0
Reheat	0	0.0	0 0.0	0.0	Return	800	0		People	4	Runarnd	78.0	0.0
Humidif	C	0.0	0.0	0.0	Exhaust	130	0		g % OA	0.0	Fn MtrTD	0.1	0.0
0-4 11	_												

Auxil

0.0 0.0 0.0 Rm Exh

System Totals

Percent	Cool	ing Loa	ad	Heati	ng Load	•••••	Cooling	Airflo		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.1	6	177	-33,339	15	255	40.0	0	0	0.0	0	0
5 - 10	0.2	9	259	-66,678	9	157	80.0	0	0	0.0	0	0
10 - 15	0.3	4	115	-100,017	10	170	120.0	0	0	0.0	0	Õ
15 - 20	0.4	7	203	-133,356	13	220	160.0	0	0	0.0	0	ō
20 - 25	0.5	6	164	-166,695	16	265	200.0	0	0	0.0	0	0
25 - 30	0.6	6	178	-200,034	17	287	240.0	0	0	0.0	0	0
30 - 35	0.7	6	164	-233,373	13	214	280.0	O	0	0.0	0	0
35 - 40	0.8	5	145	-266,712	7	112	320.0	0	0	0.0	0	0
40 - 45	0.9	7	205	-300,051	0	0	360.0	0	0	0.0	0	0
45 - 50	1.0	5	134	-333,390	0	0	400.0	0	0	0.0	0	0
50 - 55	1.1	6	176	-366,729	0	0	440.0	0	0	0.0	0	0
55 - 60	1.2	7	194	-400,068	0	0	480.0	0	0	0.0	. 0	0
60 - 65	1.3	4	121	-433,407	0	0	520.0	0	0	0.0	0	0
65 - 70	1.4	5	142	-466,746	0	0	560.0	0	0	0.0	0	0
70 - 75	1.5	8	223	-500,085	0	0	600.0	0	0	0.0	0	0
75 - 80	1.6	5	153	-533,424	0	0	640.0	0	0	0.0	0	0
80 - 85	1.7	2	69	-566,763	0	0	680.0	0	0	0.0	0	0
85 - 90	1.8	1	23	-600,102	0	0	720.0	0	0	0.0	0	0
90 - 95	1.9	0	0	-633,441	0	0	760.0	0	0	0.0	0	0
95 - 100	2.0	0	0	-666,780	0	0	800.0	100	3,049	0.0	0	0
Hours Off	0.0	0	5,915	0	0	7,080	0.0	0	5,711	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

ELEC	DEMAND	GAS	GAS DMND	
On Dook	On Dook	O- DI-	O D1-	

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	6,855	29	1,306	5
Feb	5,631	29	913	5
March	6,027	32	123	3
April	4,953	30	0	0
May	5,649	30	0	0
June	5,894	30	0	0
July	5,725	30	0	0
Aug	6,253	30	. 0	0
Sept	5,369	30	0	0
Oct	5,473	30	0	0
Nov	6,204	32	173	2
Dec	6,538	32	815	4
Total	70,571	32	3,329	5

Building Energy Consumption = Source Energy Consumption =

32,905 (Btu/Sq Ft/Year) 33,495 (Btu/Sq Ft/Year)

Floor Area = 17,4

17,438 (Sq Ft)

Emonthly kw= 364

ESOS STUDY AT WSMR - BUILDING 501-B
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO#9)

Weather File Code:

ELPASO.W

Location:

Latitude: 31.0 (deg)
Longitude: 106.0 (deg)
Time Zone: 6

Elevation: 3,918 (ft)
Barometric Pressure: 25.8 (in. Hg)

Summer Clearness Number: 1.00
Winter Clearness Number: 1.00
Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20

Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run:

13:57:58 1/20/92

Dataset Name:

501-B .TM

Block

System

.

Total

-666.8

RAD

- RADIATION

Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: OADB: 24 Net Percnt * Space Ret. Air Ret. Air Percnt * Space Space Peak Coil Peak Percnt Sens.+Lat. Sensible Latent Total Of Tot Sensible Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr 0 0 0 0.00 0 0.00 0 n 0.00 Skylite Cond n 0 0 0.00 0 0.00 * 0 0 0.00 Roof Cond 0 n n 0.00 0.00 * Λ -23,503 -23,503 6.82 Glass Solar n ٥ 0.00 0 0 0.00 * 0 0.00 Glass Cond a 0 0 0.00 0.00 * -38,926 0 -38,926 11.29 Wall Cond 0 0.00 0 0.00 * -147,589 -147,589 42.81 Partition 0 n 0.000 0.00 * 0 0 0.00 Exposed Floor Ð 0 0.00 0 0.00 * -6,347 -6,347 1.84 Infiltration 0.00 0 0.00 -128,388 -128,388 37.24 Sub Total==> 0 0.00 -344,752 0 0.00 * -344,752 100.00 Internal Loads Lights 0 0 0 0.00 0 0.00 * 0 0 0.00 People 0.00 0 0 0.00 * 0 0 0.00 Misc 0 0 0.00 0.00 * 0 0 0 0.00 Sub Total ==> 0 0 0 0 0.00 0.00 * O 0 0 0.00 Ceiling Load 0 ٥ n 0.00 0.00 * 0 0 0 0.00 Outside Air 0 Ω n 0 0.00 0 0.00 * 0 0 0.00 Sup. Fan Heat 0 0.00 0.00 * 0 0.00 Ret. Fan Heat 0.00 0.00 0 0.00 Duct Heat Pkup 0 0.00 0.00 * 0 0.00 OV/UNDR Sizing 0 0 0.00 0.00 * n 0 n Exhaust Heat O n 0.00 0.00 * O 0 Terminal Bypass ٥ 0 0.00 0.00 * 0.00 Grand Total==> 0.00 * 0.00 * -344,752 -344,752 100.00 ------COOLING COIL SELECTION-----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 17.165 Main Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Part 8,622 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 192 Opt Vent 0.0 0.0 0.0 O 0.0 0.0 0.0 0.0 0.0 0.0 Roof 12,140 0 0.0 Totals 0.0 Wall 12,148 2,778 23 ------HEATING COIL SELECTION----------AIRFLOWS (cfm)-------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Lvg Type Cooling Heating Clg % OA 0.0 Type Clg Hta (Mbh) (cfm) Deg F Deg F Vent 0 0 Clg Cfm/Sqft 0.00 SADR 0.0 68.1 Main Htg -666.8 0 0.0 0.0 Infil 0 3,047 Clg Cfm/Ton 0.00 Plenum 0.0 68.0 Aux Htg 0.0 0 0.0 0.0 Supply 0 0 Clg Sqft/Ton 0.00 Return 0.0 68.0 Preheat 0.0 0 0.0 0.0 Mincfm 0 0 Clg Btuh/Saft 0.00 Ret/OA 0.0 68.0 Reheat 0.0 0 0.0 0.0 0 0 Return No. People 0 Runarnd 0.0 68.0 Humidif 0.0 0 0.0 0.0 **Exhaust** 0 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0 n Opt Vent 0.0 0.00 0.0 Rm Exh O Htg Cfm/SqFt Fn BldTD 0.0 0.0

D3-148

Htg Btuh/SqFt -38.84

En Frict 0.0

0.0

Auxii

Aux Htg

Preheat

Reheat

Humidif

Opt Vent

Total

0.0

-0.0

0.0

0.0

0.0

0.0

0.0

3.6

0.0

0.0

0.0

800

n

0

0

0.0

49.6

0.0

0.0

0.0

Supply

Mincfm

Return

Exhaust

Rm Exh

Auxil

PTAC - PACKAGED TERMINAL AIR COND. System Peaked at Time ==> Mo/Hr: 9/17 Mo/Hr: 10/17 Mo/Hr: 0/ 0 Outside Air ==> OADB/WB/HR: 86/ 59/ 42.0 OADB: 78 OADB: 0 Space Ret. Air Ret. Air Net Percnt Space Percnt * Space Peak Coil Peak Percnt Sens.+Lat. Of Tot * Sensible Latent Total Of Tot Sensible Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (%) (Btuh) (Btuh) (%) (Btuh) (Btuh) (Btuh) (%) Skylite Solr n 0 0 0.00 0 0.00 0 0 0.00 Skylite Cond ٥ 0 0 0.00 0 0.00 0 0 0.00 Roof Cond 346 0 346 1.60 156 0.73 0 0 0.00 Glass Solar 17,010 0 17,010 78.65 19,278 89.88 0 0 0.00 2.30 * Glass Cond 498 0 498 35 0.16 0 0 0.00 Wall Cond 1,592 1,592 7.36 * 0 5.56 1,193 0 0 0.00 Partition Λ 0 0.00 * 0 0.00 0 0 0.00 Exposed Floor 0 0 0.00 0 0.00 0 0.00 Infiltration 0 0 0.00 0 -0.00 0 0.00 Sub Total ==> 19,446 89.91 0 19,446 96.33 n 20,661 n 0.00 Internal Loads 738 Lights 0 738 3.41 * 738 3.44 0 0 0.00 People 779 3.60 2.75 779 589 0 0 0.00 Misc 0 0 0 0.00 * 0 0.00 0 0 0.00 Sub Total ==> 1,517 0 0 1,517 7.01 * 1,327 6.19 0 n 0.00 Ceiling Load 0 ٥ 0.00 n 0 0.00 0 0 0.00 Outside Air 0 0 n 920 4.25 0 0.00 0 0 0.00 Sup. Fan Heat 284 1.32 0.00 0 0.00 Ret. Fan Heat 0 0 0.00 0.00 0 0.00 Duct Heat Pkup 0 0 0.00 0.00 0.00 0 OV/UNDR Sizing -540 -540 -2.50 -2.52 -540 0 0 0.00 Exhaust Heat 0 0 0 0.00 0.00 n 0.00 Terminal Bypass n 0 0.00 0 0.00 0.00 Grand Total==> 20,423 21,627 100.00 * 100.00 21,448 0 0.00 ------COOLING COIL SELECTION--------------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Mbh) (Tons) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 272 Main Cla 2.0 24.0 23.8 800 79.3 56.2 41.6 49.8 43.4 38.4 355 Part Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 0 Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 272 0 0 Totals 2.0 24.0 Wali 366 189 52 ------HEATING COIL SELECTION-----------AIRFLOWS (cfm)-------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Lvg Type Cooling Heating Clg % OA Type Clg Htg (Mbh) (cfm) Deg F Deg F 120 Clg Cfm/Sqft Vent 2.94 SADB 50.0 0.0 Main Htg -0.0 0 0.0 0.0 Infil 0 Clg Cfm/Ton 400.00 Plenum 78.0 0.0

800

0

800

120

0

0

0

0

0

0

0

Clg Sqft/Ton

Clg Btuh/Sqft

Htg Cfm/SqFt

Htg Btuh/SqFt

No. People

Htg % OA

136.03

88.22

4

0.0

0.00

0.00

Return

Ret/OA

Runarnd

Fn MtrTD

Fn BldTD

Fn Frict

78.0

79.2

78.0

0.1

0.1

0.2

0.0

0.0

0.0

0.0

0.0

0.0

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

System Totals

Percent	Cool	ing Loa	d	Heati	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.1	6	181	-33,339	17	257	40.0	0	0	0.0	0	0
5 - 10	0.2	11	326	-66,678	13	200	80.0	0	0	0.0	0	0
10 - 15	0.3	8	237	-100,017	11	169	120.0	0	0	0.0	0	0
15 - 20	0.4	8	254	-133,356	15	224	160.0	0	0	0.0	0	o
20 - 25	0.5	5	141	-166,695	13	193	200.0	0	0	0.0	0	0
25 - 30	0.6	6	176	-200,034	14	209	240.0	0	0	0.0	0	0
30 - 35	0.7	5	159	-233,373	13	190	280.0	0	0	0.0	0	0
35 - 40	0.8	6	196	-266,712	4	54	320.0	0	0	0.0	0	0
40 - 45	0.9	6	182	-300,051	0	0	360.0	0	0	0.0	0	0
45 - 50	1.0	6	197	-333,390	0	0	400.0	0	0	0.0	0	0
50 - 55	1.1	9	270	-366,729	0	0	440.0	0	0	0.0	0	0
55 - 60	1.2	4	121	-400,068	0	0	480.0	0	0	0.0	0	0
60 - 65	1.3	9	276	-433,407	0	0	520.0	0	0	0.0	0	0
65 - 70	1.4	3	106	-466,746	0	0	560.0	0	0	0.0	0	0
70 - 75	1.5	5	169	-500,085	0	0	600.0	0	0	0.0	0	0
75 - 80	1.6	3	80	-533,424	0	0	640.0	0	0	0.0	0	0
80 - 85	1.7	0	5	-566,763	0	0	680.0	0	0	0.0	0	0
85 - 90	1.8	0	0	-600,102	0	0	720.0	0	0	0.0	0	0
90 - 95	1.9	0	0	-633,441	0	0	760.0	0	0	0.0	0	0
95 - 100	2.0	0	0	-666,780	0	0	800.0	100	3,432	0.0	0	0
Hours Off	0.0	0	5.684	0	0	7,264	0.0	0	5,328	0.0	0	8,760

seasonies:

 MONTHLY	ENERGY	CONSUMPTION	***************************************
		COMPONEITON	

	ELEC On Peak	DEMAND On Peak	GAS	GAS DMND	
	On Peak	On Peak	_		
		OII I COX	On Peak	On Peak	
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)	
Jan	6,769	32	1,080	4	
Feb	6,036	29	711	4	
March	6,026	32	100	2	,
April	4,968	29	0	0	_ ′
May	5,656	30	0	0	
June	5,825	30	0	0	
July	5,652	30	0	0	
Aug	6,196	30	0	0	
Sept	5,396	30	0	0	
0ct	5,498	29	0	0	
Nov	5,529	29	135	2	
Dec	6,535	32	631	3	
Total	70,087	32	2,656	4	

Building Energy Consumption = Source Energy Consumption =

28,951 (Btu/Sq Ft/Year) 29,422 (Btu/Sq Ft/Year)

Floor Area =

17,438 (Sq Ft)

Emonthly Kw 362

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ESOS STUDY AT WSMR - BUILDING 502
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) 106.0 (deg) Longitude: Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 98 (F) Summer Design Dry Bulb: Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20

Winter Ground Relectance:

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)

0.20

Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October

System Simulation Period: January To December

Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 20:29:31 1/15/92 Dataset Name: 502 .TM

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System Peak INCHP - INCREMENTAL HEAT PUMP Peaked at Time ==> Mo/Hr: 7/16 Mo/Hr: 7/19 Mo/Hr: 13/ 1 OADB/WB/HR: 97/ 64/ 49.0 Outside Air ==> OADB: 91 OADB: 24 Space Ret. Air Ret. Air Net Percnt * Percnt * Coil Peak Space Space Peak Percnt Sens.+Lat. Sensible Total Of Tot Of Tot * Latent Sensible Space Sens Tot Sens Of Tot (Btuh) (Btuh) (Btuh) (Btuh) (%) * (%) * Envelope Loads (Btuh) (Btuh) (Btuh) (8) Skylite Solr 0 0 0.00 * 0 0.00 * 0 0 0.00 Skylite Cond 0 0 0.00 * 0.00 * 0.00 Roof Cond 12,236 12,236 4.97 * 14,284 6.33 * 3.69 -12,180 -12.180 23.15 * Glass Solar 58,900 0 58,900 23.93 52,258 Ω 0 0.00 Glass Cond 40,825 0 40,825 16.59 32,057 14.20 * -105,268 -105,268 31.88 Wall Cond 56,375 56,375 22.91 71,050 31.47 * -101,661 -101,661 30.79 0.00 0.00 . * Partition 0 0 0 ٥ ٥ 0.00 Exposed Floor 0 0 0.00 * ٥ 0.00 * -10,824 -10,824 3.28 Infiltration 0.00 0.00 * -100,282 -100,282 30.37 Sub Total ==> 68.41 * 75.14 * 168,335 168,335 169,649 -330,214 -330,214 100.00 Internal Loads Lights 32,209 0 32,209 13.09 * 52,179 23.11 * 0 0 0.00 People 5,040 5,040 2.05 3,956 1.75 * 0 0 0.00 Misc 0 0 0.00 0 0.00 O Ω 0.00 Sub Total ==> 37,249 37,249 15.14 24.86 56.135 0 ٥ 0.00 Ceiling Load 0 0 0 0.00 * 0 0.00 * ٥ 0.00 0 Outside Air 0 40.501 16.46 * 0.00 * O 0.00 Sup. Fan Heat 0 0.00 * 0.00 * 0.00 Ret. Fan Heat 0 0.00 * 0.00 0.00 Duct Heat Pkup 0.00 0.00 ٥ OV/UNDR Sizing O 0.00 0.00 0 Exhaust Heat 0 O 0 0.00 0.00 0 Terminal Bypass ٥ 0 0.00 * 0.00 0.00 Grand Total ==> 205,584 0 246,085 100.00 * 100.00 * 225.784 -330.214 -330.214 100.00 -----COOLING COIL SELECTION-----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (cfm) Deg F Deg F Grains Deg F Grains Deg F Floor 12,583 Main Clg 467.6 466.8 13,100 58.7 81.4 49.9 44.1 60.0 24.7 15.907 Part. Aux Cla 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 328 Opt Vent 0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 6,291 0 Totals 39.0 467.6 Wall 8,354 1,900 ------HEATING COIL SELECTION-----------AIRFLOWS (cfm)-------ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Cooling Ent Type Heating Clg % OA Lva 18.2 Type Clg Htg (Mbh) (cfm) 2.380 Deg F Deg F Vent. 0 Clg Cfm/Sqft 1.04 SADB 60.0 94.3 Main Htg -490.4 13,100 55.2 94.3 Infil 0 2,380 Clg Cfm/Ton 336.16 Plenum 68.0 Aux Htg 0.0 0.0 Supply 13,100 13,100 Clg Sqft/Ton 322.89 Return 78.0 68.0 Preheat -0.0 13,100 60.0 60.0 Clg Btuh/Sqft Mincfm 0 0 37.16 Ret/OA 81.4 68.0 0.0 0.0 0.0 Reheat 0 Return 13,100 13,100 No. People 20 78.0 Runarnd 68.0 Humidif 0.0 0 0.0 0.0 Exhaust 2,380 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0.0 0.0 Rm Exh 0 0 Htg Cfm/SqFt 1.04 Fn BldTD 0.0 0.0 Total -490.4 Auxil 0 0 Htg Btuh/SgFt -38.97 Fn Frict 0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 502

		Room U-Values											Room	
			(Btu/hr/sqft/F)										Capac.	
Room					Summr	Wintr		Summr	Wintr			(lb/	(Btu/	
Number	Description		Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)	
1	1ST I	FLOOR	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.358	0.000	51.2	10.24	
2	2ND I	LOOR	0.388	0.000	0.000	0.000	0.044	1.140	1.259	0.358	0.000	100.8	21.06	
Zone	1	Total/Ave.	0.388	0.750	0.000	0.000	0.044	1.140	1.259	0.358	0.000	76.0	15.65	
System	1	Total/Ave.	0.388	0.750	0.000	0.000	0.044	1.140	1.259	0.358	0.000	76.0	15.65	
Buildin	g		0.388	0.750	0.000	0.000	0.044	1.140	1.259	0.358	0.000	76.0	15.65	

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 502

			er of	Floor Area/Dupl	Total Floor		Exposed Floor	Skylight	Skl	Net Roof	Window	Win	Net Wall
Room		Dupl	icate	Room	Area	Area	Area	Area	/Rf	Area	Area	/W1	Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(\$)	(sqft)	(sqft)	(%)	(sqft)
_		_											
1	1ST FLOOR	1	1	6,291	6,291	8,115	328	0	0	0	942	22	3,320
2	2ND FLOOR	1	1	6,291	6,291	7,792	0	0	0	6,291	958	23	3,134
Zone	<pre>1 Total/Ave.</pre>				12,583	15,907	328	0	0	6,291	1,900	23	6,454
System	1 Total/Ave.				12,583	15,907	328	0	0	6,291	1,900	23	6,454
Buildin	g				12,583	15,907	328	0	0	6,291	1,900	23	6,454

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SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

System Totals

12134211414.45²4343

Percent	Cool	ing Loa	d	Heatir	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	1.9	9	228	-24,520	13	231	655.0	0	0	0.0	0	0
5 - 10	3.9	11	279	-49,041	11	198	1,310.0	0	0	0.0	0	0
10 - 15	5.8	13	325	-73,561	12	218	1,965.0	0	0	0.0	0	0
15 - 20	7.8	8	202	-98,081	8	146	2,620.1	0	0	0.0	0	0
20 - 25	9.7	9	241	-122,602	13	236	3,275.1	0	0	0.0	0	0
25 - 30	11.7	14	360	-147,122	12	223	3,930.1	0	0	0.0	0	0
30 - 35	13.6	12	312	-171,642	16	290	4,585.1	0	0	0.0	0	٥
35 - 40	15.6	8	212	-196,162	9	169	5,240.1	0	0	0.0	0	0
40 - 45	17.5	13	326	-220,683	6	109	5,895.1	0	0	0.0	0	0
45 - 50	19.5	4	105	-245,203	1	10	6,550.1	0	0	0.0	0	0
50 - 55	21.4	0	0	-269,723	0	O	7,205.1	0	0	0.0	0	0
55 - 60	23.4	0	0	-294,244	0	0	7,860.2	0	0	0.0	0	0
60 - 65	25.3	0	0	-318,764	0	0	8,515.2	0	0	0.0	0	0
65 - 70	27.3	0	0	-343,284	0	0	9,170.2	0	0	0.0	0	0
70 - 75	29.2	0	0	-367,805	0	0	9,825.2	0	0	0.0	0	0
75 - 80	31.2	0	0	-392,325	0	0	10,480.2	0	0	0.0	0	0
80 - 85	33.1	0	0	-416,845	0	0	11,135.2	0	0	0.0	0	0
85 - 90	35.1	0	0	-441,365	0	0	11,790.2	0	0	0.0	0	0
90 - 95	37.0	0	0	-465,886	0	0	12,445.3	0	0	0.0	0	0
95 - 100	39.0	0	0	-490,406	0	0	13,100.3	100	8,760	0.0	0	0
Hours Off	0.0	0	6,170	0	0	6,930	0.0	0	0	0.0	0	8,760

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	ELEC	DEMAND
	On Peak	On Peak
Month	(kWh)	(kW)
Jan	24,664	87
Feb	19,023	84
March	5,875	48
April	4,379	22
May	8,811	42
June	13,524	50
July	14,826	51
Aug	14,267	49
Sept	8,862	42
Oct	5,091	34
Nov	6,155	46
Dec	15,793	70
Total	141,270	87

Building Energy Consumption = Source Energy Consumption =

ીસ્કર્લા<u>ક્ષ્</u>રકોલા

38,318 (Btu/Sq Ft/Year)

38,318 (Btu/Sq Ft/Year)

Floor Area =

12,583 (Sq Ft)

E monthly Kw= 625

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ESOS STUDY AT WSMR - BUILDING 502
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (C-FAR) (ECO#9)

Weather File Code: ELPASO.W
Location:
Latitude: 31.0 (deg)
Longitude: 106.0 (deg)
Time Zone: 6
Elevation: 3,918 (ft)
Barometric Pressure: 25.8 (in. Hg)

Summer Clearness Number: 1.00
Winter Clearness Number: 1.00
Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 17:27:47 1/20/92
Dataset Name: 502 .TM

System	1	Peak	INCHP	- INCREME	NTAL HEAT P	UMP								
*****	*****	*****	OOLING COIL	PEAK ****	*****	*****	****	*** CLG 5	SPACE	PEAK ****	***** HE	ATING COIL	PEAK *	*****
Peaked at	t Time =	=>	Mo/Hr:	8/16			*	Mo/l	Hr: 7	7/19 *	•	Mo/Hr:	13/ 1	
Outside /	Air ==>	OA	DB/WB/HR:	96/ 63/ 49.	0		*	JAO	OB: 9	71 * *	,	OAD8:	24	
		Space	Ret. Air	Ret. Air	Net	Percnt	*	Spa	ace	Percnt *	Space P	eak Coil	Peak	Percnt
	:	Sens.+Lat.	Sensible	Latent	Total	Of Tot	*	Sensib	ole	Of Tot *	Space S	ens Tot	Sens	Of Tot
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Bti	uh)	(%) *	(Bt	uh) (Btuh)	(%)
Skylite	e Solr	0	0		0	0.00	*		0	0.00 *	,	0	0	0.00
Skylite	e Cond	0	0		0	0.00	*		0	0.00 *		0	0	0.00
Roof Co	ond	12,236	0		12,236	5.58	*	14,2	284	6.96 *	-12,	180 -1	2,180	4.98
Glass S	Solar	68,336	0		68,336	31.16	*	/ 55,1		26.85 *		0	. 0	0.00
Glass (Cond	10,605	0		10,605			8,7		4.25 *	<i>V</i>	623 -2	6,623	10.89
Wall Co	ond	55,424	0		55,424		*	71,0		34.61 *			1,661	41.57
Partiti	ion	. 0			, 0				0	0.00 *	-	0	0	0.00
Exposed	d Floor	0			0		*		0	0.00 *	/		0,824	4.43
Infiltr	ration	0			0		*		0	0.00 *	-		3.262	38.14
Sub Tot	tal==>	146,601	0		146,601		*	149,1	168	72.66 *	-		4,550	100.00
Internal	Loads	·			·		*	•		*	- ,		,	
Lights		32,209	0		32,209	14.69	*	52,1	179	25.42 *		0	0	0.00
People		5,040			5,040	2.30	*	3,9	756	1.93 *		0	0	0.00
Misc		0	0	0	0	0.00	*		0	0.00 *		0	0	0.00
Sub Tot	tal==>	37,249	0	0	37,249	16.98	*	56,1	135	27.34 *		0	0	0.00
Ceiling L	Load	0	0		0	0.00	*		0	0.00 *		0	0	0.00
Outside A	Air	0	0	0	35,458	16.17	*		0	0.00 *		0	0	0.00
Sup. Fan	Heat				0	0.00	*			0.00 *			0	0.00
Ret. Fan	Heat		0		0	0.00	*			0.00 *			0	0.00
Duct Heat	t Pkup		0		0	0.00	*			0.00 *			0	0.00
OV/UNDR S	Sizing	0			0	0.00	*		0	0.00 *		0	0	0.00
Exhaust H	leat		0	0	. 0	0.00	*			0.00 *			0	0.00
Terminal	Bypass		0	0	0	0.00	*			0.00 *			0	0.00
Grand Tot	tal==>	183,850	. 0	0	219,308	100.00	*	205,3	803	100.00 *	-244,	550 -24	4,550	100.00
	·		C00	LING COIL S	ELECTION							AREAS		
	Total	Capacity	Sens Cap.	Coil Airfl	Enteri	ng DB/WB/	HR	Leavi	ng DB	/WB/HR	Gross To	tal Gl	ass (sf) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	g F Grai	ns	Deg F D	eg F	Grains	Floor	12,583		
Main Clg	39.0	467.6	467.2	11,912	81.3 5	8.8 50	.1	60.0	42.5	18.9	Part	15,907		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0 0	.0	0.0	0.0	0.0	ExFlr	328		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0 0	.0	0.0	0.0	0.0	Roof	6,291		0 0
Totals	39.0	467.6									Wall	8,354	1,9	00 23
	HEATIN	G COIL SEL	ECTION		AII	RFLOWS (c	fm)		E	NGINEERING	CHECKS	TEMPE	PATHRES	(F)
	Capacit			Lvg	Туре	Cooling		ating		% OA	18.6	Type	Clg	Htg
	(Mbh)			Deg F	Vent	2,214		0		Cfm/Sqft	0.95	SADB	60.0	
Main Htg	-490.		=	89.4	Infil	0		2,214		Cfm/Ton	305.67	Plenum	78.0	68.0
Aux Htg	0.	•	0 0.0	0.0	Supply	11,912		11,912	_	Sqft/Ton	322.89	Return	78.0	68.0
Preheat	-0.			60.0	Mincfm	0		0		Btuh/Sqft	37.16	Ret/OA	81.3	
Reheat	0.	•	0 0.0	0.0	Return	11,912		11,912		People	20	Runarnd	78.0	
Humidif	0.		0.0	0.0	Exhaust	2,214		0		% OA	0.0	Fn MtrT(0.0
Opt Vent	0.	0	0.0	0.0	Rm Exh	0		0		Cfm/SqFt	0.95	Fn BldTi		0.0
Total	-490.				Auxil	0		0		Btuh/SqFt	-38.97	fn Fric		0.0
						•		-	3					٠.٠

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BUILDING U-VALUES - ALTERNATIVE 2 EFFICIENT WINDOWS - BLDG. 502

------ BUILDING U-VALUES -----

	Room U-Values											Room	Room	
						(Btu	/hr/sqf	t/F)				Mass	Capac.	
Room					Summr	Wintr		Summr	Wintr			(lb/	(Btu/	
Number	Descr	iption	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)	
1	1ST FLO	OOR	0.388	0.750	0.000	0.000	0.000	0.310	0.318	0.358	0.000	51.2	10.24	
2	2ND FL	DOR				0.000						100.8	21.06	
Zone	1	Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	76.0	15.65	
System	1	Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	76.0	15.65	
Building	9		0.388	0.750	0.000	0.000	0.044	0.310	0.318	0.358	0.000	76.0	15.65	

BUILDING AREAS - ALTERNATIVE 2 EFFICIENT WINDOWS - BLDG. 502

BUILDING AREAS -----

Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	/Rf	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	6,291	6,291	8,115	328	0	0	0	942	22	3,320
2	2ND FLOOR	1	1	6,291	6,291	7,792	0	0	0	6,291	958	23	3,134
Zone	1 Total/Ave.	•			12,583	15,907	328	0	0	6,291	1,900	23	6,454
System	1 Total/Ave.				12,583	15,907	328	0	0	6,291	1,900	23	6,454
Buildin •	9				12,583	15,907	328	0	0	6,291	1,900	23	6,454

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

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SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

System Totals

Percent	Cooling Load		Heating Load		Cooling Airflow			Heating Airflow				
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.		Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	1.9	13	371	-24,520	11	168	595.6	0	0	0.0	0	0
5 - 10	3.9	10	286	-49,041	11	173	1,191.2	0	0	0.0	0	0
10 - 15	5.8	12	348	-73,561	10	150	1,786.8	0	0	0.0	0	0
15 ~ 20	7.8	9	257	-98,081	12	183	2,382.4	0	0	0.0	0	0
20 - 25	9.7	11	304	-122,602	15	232	2,978.0	0	0	0.0	0	0
25 - 30	11.7	14	392	-147,122	9	143	3,573.6	0	0	0.0	0	0
30 - 35	13.6	12	336	-171,642	19	301	4,169.2	0	0	0.0	0	0
35 - 40	15.6	12	348	-196,162	8	127	4,764.8	0	0	0.0	0	0
40 - 45	17.5	7	193	-220,683	5	70	5,360.4	0	0	0.0	0	0
45 - 50	19.5	0	0	-245,203	0	0	5,956.0	0	0	0.0	0	0
50 - 55	21.4	0	0	-269,723	0	0	6,551.5	0	0	0.0	0	0
55 - 60	23.4	0	0	-294,244	0	0	7,147.1	.0	0	0.0	0	0
60 - 65	25.3	0	0	-318,764	0	0	7,742.7	0	0	0.0	0	0
65 - 70	27.3	0	0	-343,284	0	0	8,338.3	0	0	0.0	0	0
70 - 75	29.2	0	0	-367,805	0	0	8,933.9	0	0	0.0	0	0
75 - 80	31.2	0	0	-392,325	0	0	9,529.5	0	0	0.0	. 0	0
80 - 85	33.1	0	0	-416,845	0	0	10,125.1	0	0	0.0	0	0
85 - 90	35.1	0	0	-441,365	0	0	10,720.7	0	0	0.0	0	0
90 - 95	37.0	0	0	-465,886	0	0	11,316.3	0	0	0.0	0	0
95 - 100	39.0	0	0	-490,406	0	0	11,911.9	100	8,760	0.0	0	0
Hours Off	0.0	0	5,925	0	0	7,213	0.0	0	0	0.0	0	8,760

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MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

MONTHLY ENERGY CONSUMPTION

	ELEC	DEMAND
	On Peak	On Peak
Month	(kWh)	(kW)
Jan	21,938	67
Feb	16,616	64
March	5,578	46
April	4,379	29
May	8,955	41
June	13,038	47
July	14,164	48
Aug	13,924	47
Sept	9,203	41
Oct	5,237	35
Nov	5,654	46
Dec	13,711	52
Total	132,399	67

ding Energy Consumption = ce Energy Consumption =

35,912 (Btu/Sq Ft/Year) 35,912 (Btu/Sq Ft/Year)

Floor Area =

12,583 (Sq Ft)

100000000

Emmithly KW = 563

ESOS STUDY AT WSMR - BUILDING 502 WHITE SANDS MISSILE RANGE NM US ARMY EMC ENGINEERS, INC.

EFFICIENT WINDOWS: ALT 1-BSLN, ALTZ-ECO (GREY) (ECO#9)

Weather File Code: ELPASO.W Location: 31.0 (deg) Latitude: Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 17:45:47 1/20/92 Dataset Name: 502 .TM

Peak

System

INCHP

- INCREMENTAL HEAT PUMP

Peaked at Time ==> Mo/Hr: 7/17 Mo/Hr: 7/19 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 96/ 63/ 49.0 OADB: 91 OADB: 24 Space Ret. Air Ret. Air Net Percnt * Percnt * Space Coil Peak Space Peak Percnt Sens.+Lat. Sensible Of Tot * Latent Total Of Tot * Sensible Space Sens Tot Sens Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) * (Btuh) (%) * (Btuh) (Btuh) (%) Skylite Solr 0 0 0.00 * 0.00 * 0 0 0 0 0.00 Skylite Cond 0 0 0.00 * ٥ 0 0.00 * 0 0.00 0 Roof Cond 12,236 0 12,236 6.30 * 7.70 * 14,284 -12,180 -12,180 4.97 Glass Solar 39,900 0 39,900 20.55 * 18.95 * 35,158 0 0 0.00 Glass Cond 11,328 0 11,328 5.83 8,872 4.78 -27,095 -27,095 11.06 Wall Cond 56,375 0 56,375 29.03 71,050 38.30 -101,661 -101,661 41.49 Partition 0 0 0.00 0 0.00 0 0.00 Ω Exposed Floor n 0 0.00 * n 0.00 * -10,824 -10,824 4.42 Infiltration n 0 0.00 * 0 0.00 * -93,262 -93,262 38.06 Sub Total==> 119,839 119,839 61.72 * 129,364 69.74 -245,022 -245,022 100.00 Internal Loads Lights 32,209 16.59 * 32,209 0 52,179 28.13 0 0 0.00 People 5,040 5,040 2.60 * 3,956 2.13 0 0 0.00 Misc 0 0 0 Ω 0.00 * 0 0.00 Ω n 0.00 Sub Total ==> 37,249 0 0 37,249 19.18 * 56.135 30.26 n O 0.00 Ceiling Load 0 0 0 0.00 * 0 0.00 * n ٥ 0.00 Outside Air 0 0 37,077 19.10 * 0.00 0 0.00 Sup. Fan Heat 0 0.00 * 0.00 0.00 Ret. Fan Heat 0 0 0.00 * 0.00 0 0.00 Duct Heat Pkup 0 0.00 * 0 0.00 n OV/UNDR Sizing 0.00 0.00 n 0 Exhaust Heat 0 0 0.00 4 0.00 0 0.00 Terminal Bypass 0.00 * 0 O 0.00 0.00 Grand Total ==> 157,088 0 194,165 100.00 * 185,499 100.00 * -245,022 -245.022 100.00 -----COOLING COIL SELECTION-----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Deg F Grains 12,583 Floor Main Clg 39.0 467.6 467.6 10,763 59.0 50.2 60.0 40.7 12.9 Part 15,907 Aux Clg 0.0 0.0 0.0 O 0.0 0.0 0.0 0.0 0.0 0.0ExFlr 328 Opt Vent 0.0 0.0 0.0 0 0.0 0.00.0 0.0 0.0 0.0 Roof 6,291 0 Totals 39.0 467.6 Wall 8,354 1,900 23 ------HEATING COIL SELECTION----------AIRFLOWS (cfm)-------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Lva Type Cooling Heating Clg % OA 20.6 Type Clg Htg (Mbh) (cfm) Deg F Deg F 2,214 Vent n Clg Cfm/Sqft 0.86 SADB 91.8 Main Htg -490.4 10.763 44.2 91.8 Infil O-2,214 Clg Cfm/Ton 276.18 Plenum 78.0 68.0 Aux Htg 0.0 - 0 0.0 0.0 Supply 10,763 10,763 Clg Sqft/Ton 322.89 78.0 Return 68.0 Preheat -0.0 10,763 59.0 60.0 0 Mincfm 0 Clg Btuh/Sqft 37.16 Ret/OA 81.8 68.0 Reheat 0.0 0 0.0 0.0 Return 10,763 10,763 No. People 20 Runarnd 78.0 68.0 Humidif 0.0 0 0.0 0.0 2,214 Exhaust 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0 0.0 0.0 O. Htg Cfm/SqFt Rm Exh 0 0.86 Fn BldTD 0.0 0.0 Total -490.4 Auxil 0 Htg Btuh/SqFt -38.97 Fn Frict 0.0 0.0

D3-166

BUILDING U-VALUES - ALTERNATIVE 3
EFFICIENT WINDOWS (GREY) BLDG. 502

	Room U-Values											Room	
					(Btu		Mass	Capac.					
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/	
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)·	sqft/F)	
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	0.315	0.324	0.358	0.000	51.2	10.24	
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.044	0.315	0.324	0.358	0.000	100.8	21.06	
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.315	0.324	0.358	0.000	76.0	15.65	
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.315	0.324	0.358	0.000	76.0	15.65	
Building	3	0.388	0.750	0.000	0.000	0.044	0.315	0.324	0.358	0.000	76.0	15.65	

BUILDING AREAS - ALTERNATIVE 3
EFFICIENT WINDOWS (GREY) BLDG. 502

BUILDING AREAS -----

				Floor	Total		Exposed						
		Numb	er of	Area/Dupl	Floor	Partition	Floor	Skylight	skl	Net Roof	Window	Win	Net Wall
Room		Dupl	icate	Room	Area	Area	Area	Area	/Rf	Area	Area	/Wl	Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	1ST FLOOR	1	1	6,291	6,291	8,115	328	0	0	0	942	22	3,320
2	2ND FLOOR	1	1	6,291	6,291	7,792	0	0	0	6,291	958	23	3,134
Zone	1 Total/Ave	•			12,583	15,907	328	0	0	6,291	1,900	23	6,454
System	1 Total/Ave	•			12,583	15,907	328	0	0	6,291	1,900	23	6,454
Buildir	ng _				12,583	15,907	328	0	0	6,291	1,900	23	6,454

SYSTEM LOAD PROFILE------

System Totals

Percent	Cool	ing Loa	ad	Heatir	ng Load	•••••	Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	1.9	12	316	-24,520	16	297	538.1	0	0	0.0	0	0
5 - 10	3.9	13	355	-49,041	12	216	1,076.3	0	0	0.0	0	0
10 - 15	5.8	13	344	-73,561	10	184	1,614.4	0	0	0.0	0	0
15 - 20	7.8	10	272	-98,081	9	154	2,152.6	0	0	0.0	0	0
20 - 25	9.7	13	353	-122,602	14	254	2,690.7	0	0	0.0	0	0
25 - 30	11.7	17	473	-147,122	11	193	3,228.9	0	0	0.0	0	0
30 - 35	13.6	9	243	-171,642	17	310	3,767.0	0	0	0.0	0	0
35 - 40	15.6	13	349	-196,162	7	127	4,305.2	0	0	0.0	0	0
40 - 45	17.5	1	40	-220,683	4	70	4,843.3	0	0	0.0	0	0
45 - 50	19.5	0	0	-245,203	0	0	5,381.4	0	0	0.0	0	0
50 - 55	21.4	0	0	-269,723	0	0	5,919.6	0	0	0.0	0	0
55 - 60	23.4	0	0	-294,244	0	0	6,457.7	0	. 0	0.0	0	0
60 - 65	25.3	0	0	-318,764	0	0	6,995.9	0	0	0.0	0	0
65 - 70	27.3	0	0	-343,284	0	0	7,534.0	0	0	0.0	0	0
70 - 75	29.2	0	0	-367,805	0	0	8,072.2	0	0	0.0	0	0
75 - 80	31.2	0	0	-392,325	0	0	8,610.3	0	0	0.0	0	0
80 - 85	33.1	0	0	-416,845	0	0	9,148.5	0	0	0.0	0	0
85 - 90	35.1	0	0	-441,365	0	0	9,686.6	0	0	0.0	0	0
90 - 95	37.0	0	0	-465,886	0	0	10,224.7	0	0	0.0	0	0
95 - 100	39.0	0	0	-490,406	0	0	10,762.9	100	8,760	0.0	0	0
Hours Off	0.0	0	6,015	0	0	6,955	0.0	0	0	0.0	0	8,760

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------ MONTHLY ENERGY CONSUMPTION ------

	ELEC	DEMAND
	On Peak	On Peak
Month	(kWh)	(kW)
Jan	23,000	67
Feb	17,560	64
March	5,737	46
April	4,379	21
May	8,700	39
June	12,456	45
July	13,553	45
Aug	13,310	44
Sept	8,591	39
Oct	5,115	32
Nov	5,846	46
Dec	14,564	52
Total	132,812	67

Building Energy Consumption = Source Energy Consumption =

36,024 (Btu/Sq Ft/Year) 36,024 (Btu/Sq Ft/Year) Floor Area = 12,583 (Sq Ft)

Z monthly KW= 540

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TRACE 600 ANALYSIS
by
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ESOS STUDY AT WSMR - BUILDING 502 WHITE SANDS MISSILE RANGE NM US ARMY EMC ENGINEERS, INC. EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO #9) (BRONZE)

Hg)

willer occurress number.	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
	*	

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Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period:	May To October	
System Simulation Period:	January To December	
Cooling Load Methodology:	TETD/Time Averaging	

Time/Date Program was Run:	18: 3:48	1/20/92
Dataset Name:	502 .TM	

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System 1 Peak INCHP - INCREMENTAL HEAT PUMP Peaked at Time ==> Mo/Hr: 7/17 Mo/Hr: 7/19 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 96/ 63/ 49.0 OADB: 91 OADB: 24 Space Ret. Air Ret. Air Net Percnt * Percnt * Space Peak Coil Peak Space Sens.+Lat. Sensible Latent Total Of Tot Sensible Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (%) * (Btuh) (Btuh) (%) (Btuh) (Btuh) (Btuh) (%) 0.00 * Skylite Solr 0 0 0.00 0 0.00 0 0 0 Skylite Cond 0 0.00 * 0.00 * 0 0 0 0 0 0.00 Roof Cond 12,236 0 12,236 6.30 * 14,284 7.70 * -12,180 -12,180 4.97 Glass Solar 39,900 0 39,900 20.55 18.95 * 35,158 0 0 0.00 Glass Cond 11,330 0 11,330 5.84 8.873 4.78 * -27.099 -27,099 11.06 Wall Cond 56,375 0 56,375 29.03 * 38.30 * -101,661 -101,661 71,050 41.49 0.00 * Partition n 0 0.00 * ۵ 0 0 0.00 Exposed Floor 0 0.00 0.00 * -10,824 -10,824 4.42 Infiltration 0 0 0.00 n 0.00 * -93,262 -93,262 38.06 Sub Total ==> 119,840 61.72 * 69.74 * O 119,840 129,366 -245,026 -245,026 100.00 Internal Loads Lights 32,209 0 32,209 16.59 52,179 28.13 * 0 0 0.00 People 5.040 5,040 2.60 * 3,956 2.13 * n n 0.00 Misc O n 0.00 * 0.00 * n n 0 0 n 0.00 Sub Total ==> 37,249 Ω O 37,249 19.18 * 56,135 30.26 * 0 0 0.00 Ceiling Load n 0 0 0.00 * 0 0.00 * 0 0.00 Outside Air 37,077 19.10 * 0.00 * 0 0.00 Sup. Fan Heat 0 0.00 0.00 * 0 0.00 Ret. Fan Heat n 0.00 0.00 * 0 ß 0.00 Duct Heat Pkup 0.00 * 0.00 * O n n 0.00 OV/UNDR Sizing n 0.00 * 0 0.00 * 0 Exhaust Heat 0 0 0.00 0.00 0 0 Terminal Bypass 0 0.00 0.00 0 0.00 Grand Total ==> 157,090 O 194,166 100.00 * 100.00 * 0 185,501 -245,026 -245,026 100.00 -----COOLING COIL SELECTION----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains 12,583 Floor Main Clg 39.0 467.6 467.6 10.763 59.0 81.8 50.2 60.0 40.7 12.9 Part 15,907 Aux Cla 0.0 0.0 0.0 Ω 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 328 Opt Vent 0.0 0.0 0.0 O 0.0 0.0 0.0 0.0 0.0 0.0 Roof 6,291 0 0 Totals 39.0 467.6 8,354 Wall 1,900 23 ------HEATING COIL SELECTION-----------AIRFLOWS (cfm)--------ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Type Cooling Heating Clg % OA 20.6 Type Clg Htg 2,214 (Mbh) (cfm) Deg F Vent 0 Clg Cfm/Sqft 0.86 SADB 60.0 91.8 Main Ktg -490.4 10,763 44.2 91.8 Infil 0 2,214 Clg Cfm/Ton 276.19 Plenum 78.0 68.0 Aux Htg 0.0 0 0.0 0.0 Supply 10,763 10.763 Clg Sqft/Ton 322.89 Return 78.0 68.0 Preheat -0.0 10,763 59.0 60.0 Mincfm n 0 Clg Btuh/Sqft 37.16 Ret/OA 81.8 68.0 Reheat 0.0 0 0.0 0.0 Return 10,763 10,763 No. People 20 Runarnd 78.0 68.0 Humidif 0.0 0 0.0 0.0 Exhaust 0 2.214 Htg % OA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0 0.0 0.0 Rm Exh 0 0 Htg Cfm/SqFt 0.86 Fn BldTD 0.0 0.0 Total -490.4 Auxil 0 Htg Btuh/SqFt -38.97 Fn Frict 0.0 0.0

BUILDING U-VALUES - ALTERNATIVE 4
EFFICIENT WINDOWS (BRONZE) BLDG. 502

------ BUILDING U-VALUES-----

	Room U-Values										Room	Room
					(Btu	ı/hr/sqf	ft/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	0.316	0.324	0.358	0.000	51.2	10.24
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.044	0.316	0.324	0.358	0.000	100.8	21.06
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.316	0.324	0.358	0.000	76.0	15.65
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.044	0.316	0.324	0.358	0.000	76.0	15.65
Building	9	0.388	0.750	0.000	0.000	0.044	0.316	0.324	0.358	0.000	76.0	15.65

BUILDING AREAS - ALTERNATIVE 4
EFFICIENT WINDOWS (BRONZE) BLDG. 502

BUILDING AREAS -----

Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)		Net Roof Area (sqft)	Window Area (sqft)	/WL	Net Wall Area (sqft)
1	1ST FLOOR	1	1	6,291	6,291	8,115	328	0	0	0	942	22	3,320
2	2ND FLOOR	1	1	6,291	6,291	7,792	0	0	0	6,291	958	23	3,134
Zone	1 Total/Ave	•			12,583	15,907	328	0	0	6,291	1,900	23	6,454
System	1 Total/Ave	•			12,583	15,907	328	0	0	6,291	1,900	23	6,454
Buildin	g				12,583	15,907	328	0	0	6,291	1,900	23	6,454

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 4

System Totals

Percent	Cool	ling Loa	ad	Heati	ng Load	•••••	Cooling	Airflo		Heating	Airflo	
Design	· Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	1.9	12	316	-24,520	16	297	538.1	0	0	0.0	0	0
5 - 10	3.9	13	355	-49,041	12	216	1,076.3	0	0	0.0	0	0
10 - 15	5.8	13	344	-73,561	10	184	1,614.4	0	0	0.0	0	0
15 - 20	7.8	10	272	-98,081	9	154	2,152.6	0	0	0.0	0	0
20 - 25	9.7	13	353	-122,602	14	254	2,690.7	0	0	0.0	0	0
25 - 30	11.7	17	473	-147,122	11	193	3,228.9	0	0	0.0	0	0
30 - 35	13.6	9	243	-171,642	17	310	3,767.0	0	0	0.0	0	0
35 - 40	15.6	13	349	-196,162	7	127	4,305.2	0	0	0.0	0	0
40 - 45	17.5	1	40	-220,683	4	70	4,843.3	0	0	0.0	0	0
45 - 50	19.5	-0	0	-245,203	0	0	5,381.5	0	0	0.0	0	0
50 - 55	21.4	0	0	-269,723	0	0	5,919.6	0	0	0.0	0	0
55 - 60	23.4	0	0	-294,244	0	0	6,457.8	0	0	0.0	0	0
60 - 65	25.3	0	0	-318,764	0	0	6,995.9	0	0	0.0	0	0
65 - 70	27.3	0	0	-343,284	0	0	7,534.1	0	0	0.0	0	0
70 - 75	29.2	0	0	-367,805	0	0	8,072.2	0	0	0.0	0	0
75 - 80	31.2	0	0	-392,325	0	0	8,610.4	0	0	0.0	0	0
80 - 85	33.1	0	0	-416,845	0	0	9,148.5	0	0	0.0	0	. 0
85 - 90	35.1	0	0	-441,365	0	. 0	9,686.7	0	0	0.0	0	0
90 - 95	37.0	0	0	-465,886	0	0	10,224.8	0	0	0.0	0	0
95 - 100	39.0	0	0	-490,406	0	0	10,763.0	100	8,760	0.0	0	0
Hours Off	0.0	0	6,015	0	0	6,955	0.0	0	0	0.0	0	8,760

ensmissionism.

MONTH	LY	ENF	2 G Y	CONS	HMPT	T O N

	ELEC	DEMAND
	On Peak	On Peak
Month	(kWh)	(kW)
Jan	23,000	67
Feb	17,560	64
March	5,737	46
April	4,379	21
May	8,700	39
June	12,456	45
July	13,553	45
Aug	13,310	44
Sept	8,591	39
Oct	5,115	32
Nov	5,846	46
Dec	14,564	52
Total	132,812	67

Building Energy Consumption =
Source Energy Consumption =

36,024 (Btu/Sq Ft/Year) 36,024 (Btu/Sq Ft/Year)

Floor Area =

12,583 (Sq Ft)

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ESOS STUDY AT WSMR - BUILDING 503
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.

EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO # 9)

Weather File Code: ELPASO.W
Location:

 Latitude:
 31.0 (deg)

 Longitude:
 106.0 (deg)

 Time Zone:
 6

 Elevation:
 3,918 (ft)

 Barometric Pressure:
 25.8 (in. Hg)

Summer Clearness Number: 1.00
Winter Clearness Number: 1.00
Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)

Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 16:27:20 1/10/92

Dataset Name: 503 .TM

0.0

0.0

0.0

-530.0

0.0

0.0

0.0

0

0.0

0.0

0.0

Return

Exhaust

Rm Exh

Auxil

Reheat

Humidif

Opt Vent

Total

PAGE 3

Block RAD - RADIATION System Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: 0 OADB: 24 Space Ret. Air Ret. Air Net Percnt * Space Percnt * Space Peak Coil Peak Percnt Sens.+Lat. Sensible Latent Total Of Tot Sensible Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) * (Btuh) (Btuh) (%) Skylite Solr 0 0 0 0.00 0 0.00 * 0 0 0.00 Skylite Cond 0 0 0 0.00 0 0.00 * 0 0 0.00 Roof Cond 0 0 0.00 0 0.00 * -58,679 -58,679 12.90 Glass Solar 0 0 0 0.00 0.00 * 0 0 n 0.00 Glass Cond 0 0 0 0.00 ٥ 0.00 * -150,308 -150,308 33.03 Wall Cond 0 0.00 0.00 * -137,622 -137,622 30.24 Partition 0 0.00 0.00 0 0.00 0 Exposed Floor 0 0 0.00 0.00 * -13,767 -13,767 3.03 Infiltration O 0.00 0.00 -94,661 -94,661 20.80 Sub Total ==> 0.00 0.00 -455,036 -455,036 100.00 Internal Loads Lights 0 n 0 0.00 0 0.00 * 0 0.00 People 0 0.00 0.00 0 0 0.00 Misc 0 0.00 0.00 0 0.00 0 Sub Total==> 0.00 0.00 0 0 0.00 0 Ceiling Load 0 0.00 0 0.00 0 0 0 0.00 Outside Air 0 0.00 0.00 0 0 0.00 Sup. Fan Heat 0 0.00 0.00 0.00 Ret. Fan Heat 0 0 0.00 0.00 0.00 Duct Heat Pkup 0.00 0.00 0 0.00 OV/UNDR Sizing 0 0.00 0.00 ٥ Exhaust Heat 0 0 0.00 0.00 0 0 Terminal Bypass o 0.00 0.00 0.00 Grand Total==> 0.00 0.00 * -455,036 -455,036 100.00 -------COOLING COIL SELECTION------

						•						nn			
	Total	Capacity	Sens Cap.	Coil Airfl	Ent	ering D	B/WB/HR	Lea	ving DB	/WB/HR	Gross 1	otal	Glass	(sf)	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F	Deg F	Grains	Deg F	Deg F	Grains	Floor	14,496			
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Part	11,708			
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	417			
Opt Vent	0.0	0.0	0.0	0	0.0	0,0	0.0	0.0	0.0	0.0	Roof	7,248		0	0
Totals	0.0	0.0									Wall	11,450		2,713	24
	HEATIN	G COIL SELE	CTION			-AIRFLO	WS (cfm)	E	NGINEERING	CHECKS	TE	PERATU	TRES (F)
	Capacit	y Coil Ai	rfl Ent	Lvg	Туре	Çoo	ling	Heating	Clg	% OA	0.0	Ty	pe (:lg	Htg
	(Mbh)	(cfm	a) Deg 1	F Deg F	Vent		0	0	Clg	Cfm/Sqft	0.00	SADE		0.0	68.1
Main Htg	-530.	0	0 0.0	0.0	Infil		0	2,247	Clg	Cfm/Ton	. 0.00	Plen	ım.	0.0	68.0
Aux Htg	0.	0	0 0.0	0.0	Supply	-	0	0	Clg	Sqft/Ton	0.00	Retu	rn	0.0	68.0
Preheat	0.	0	0 0.0	0.0	Mincfm		0	0	Clg	Btuh/Sqft	0.00	Ret/0)A	0.0	68.0

0

0

No. People

Htg Cfm/SqFt

Htg Btuh/SqFt

Htg % OA

Runarnd

Fn MtrTD

Fn BldTD

Fn Frict

0.00

-36.56

0.0

0.0

0.0

0.0

0.0

0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 503

------BUILDING U-VALUES-----

		Room U-Values									Room	Room
					(Btu	/hr/sqf	t/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.358	0.000	48.3	9.66
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.184	1.140	1.259	0.358	0.000	99.8	20.85
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.184	1.140	1.259	0.358	0.000	74.0	15.25
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.184	1.140	1.259	0.358	0.000	74.0	15.25
Buildin	g	0.388	0.750	0.000	0.000	0.184	1.140	1.259	0.358	0.000	74.0	15.25

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 503

BUILDING AREAS -----

Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	ı	7,248	7,248	5,854	417	0	0	0	1,356	24	4,368
2	2ND FLOOR	1	1	7,248	7,248	5,854	0	0	0	7,248	1,356	24	4,368
Zone	1 Total/Ave.				14,496	11,708	417	0	0	7,248	2,713	24	8,737
System	1 Total/Ave.				14,496	11,708	417	0	0	7,248	2,713	24	8,737
Buildin	g				14,496	11,708	417	0	0	7,248	2,713	24	8,737

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

System Totals

Percent	Cool	ling Loa	id	Heatin	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-26,501	15	321	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-53,001	15	310	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-79,501	9	185	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-106,002	13	277	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-132,503	6	117	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-159,003	10	209	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-185,504	9	196	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-212,004	12	243	0.0	0	0	0.0	0	o
40 - 45	0.0	0	0	-238,505	7	153	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-265,005	4	93	0.0	0	0	0.0	0	0
50 ~ 55	0.0	0	0	-291,506	0	0	0.0	0	0	0.0	0	0
55 ~ 60	0.0	0	0	-318,006	0	0	0.0	0	. 0	0.0	0	0
60 - 65	0.0	0	0	-344,507	0	0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-371,007	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-397,508	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-424,008	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-450,509	0	Ō	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-477,009	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-503,510	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-530,010	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,656	0.0	. 0	8,760	0.0	0	8,760

------ MONTHLY ENERGY CONSUMPTION -----

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	4,851	23	1,075	4
Feb	4,351	23	819	4
March	4,661	23	188	2
April	3,984	22	0	0
May	4,330	22	0	0
June	4,303	22	0	0
July	4,010	22	0	0
Aug	4,489	22	. 0	0
Sept	3,984	22	0	0
Oct	4,330	22	0	0
Nov	4,243	23	193	2
Dec	4,574	23	699	3
Total	52,110	23	2,975	4

Building Energy Consumption = 32,791 (Btu/Sq Ft/Year)
Source Energy Consumption = 33,425 (Btu/Sq Ft/Year)

Floor Area = 14,496 (Sq Ft)

TRACE 600 ANALYSIS

ESOS STUDY AT WSMR - BUILDING 503 WHITE SANDS MISSILE RANGE NM US ARMY EMC ENGINEERS, INC.

EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO CLEAR

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F)

Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft) Air Specific Heat: 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft) Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 15:21:10 1/17/92 Dataset Name: 503 .TM

Block

RAD

- RADIATION

System

sinaddinidi

Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: 0 OADB: 24 Space Ret. Air Ret. Air Net Percnt Percnt * Space Coil Peak Space Peak Percnt Sens.+Lat. Sensible Latent Of Tot Total Sensible Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) * (Btuh) (Btuh) (%) Skylite Solr 0 n 0.00 0 0 0.00 * 0 0 0.00 Skylite Cond n n 0.00 0 0.00 0 .0.00 0 Roof Cond n 0 0.00 0 0.00 -58,679 -58,679 17.46 Glass Solar 0 0 0 0.00 0 0.00 0 0 0.00 Glass Cond 0 0 0 0.00 0 0.00 -38,014 -38,014 11.31 Wall Cond 0 n 0 0.00 0 0.00 -137,622 -137,622 40.94 Partition 0 0 0.00 0 0.00 0 0 0.00 Exposed Floor 0 0 0.00 0.00 n -13,767 -13,767 4.10 Infiltration 0 0 0.00 0.00 -88,034 -88,034 26.19 Sub Total ==> n 0 0 0.00 -336,116 -336,116 100.00 Internal Loads Lights 0 O 0.00 * 0 0.00 0 Û 0.00 People 0 0 0.00 0 0.00 0 n 0.00 Misc 0 0 0.00 Û 0 0.00 n 0 0.00 Sub Total==> 0 0 0 0 0.00 0 0.00 O 0.00 Ceiling Load 0 0 0 0.00 0 0.00 * 0 0.00 Outside Air 0 0.00 * 0.00 0.00 Sup. Fan Heat 0.00 * 0 0.00 * 0.00 Ret. Fan Heat 0 0 0.00 * 0.00 * 0 0.00 Duct Heat Pkup ۵ 0 0.00 * 0.00 * n OV/UNDR Sizing 0 0.00 0.00 0 Exhaust Heat 0 0 0.00 0.00 0 0.00 Terminal Bypass 0 0.00 0.00 0.00 Grand Total ==> 0 0 0 0.00 * 0.00 * -336,116 -336,116 100.00 -----COOLING COIL SELECTION-----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 14,496 Main Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Part 11,708 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Exflr 417 Opt Vent 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 7,248 0 0 Totals 0.0 Wall 11,450 2,713 24 ------HEATING COIL SELECTION-----------AIRFLOWS (cfm)------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Lvq Type Cooling Heating Clg % OA 0.0 Type Clg Htg (Mbh) (cfm) Deg F Deg F 0 Vent U Clg Cfm/Sqft 0.00 SADB 0.0 68.1 Main Htg -530.0 0 0.0 0.0 Infil 0 2,090 Clg Cfm/Ton Plenum 0.00 0.0 68.0 Aux Htg 0.0 Ω 0.0 0.0 Supply 0 Clg Sqft/Ton 0.00 Return 0.0 68.0 Preheat 0.0 0 0.0 0.0 Mincfm Ω 0 Clg Btuh/Sqft 0.00 Ret/OA 0.0 68.0 Reheat 0.0 0 0.0 0.0 0 Return n No. People 0 Runarnd 0.0 68.0 Humidif 0.0 0.0 0.0 Exhaust 0 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0 0.0 0.0 Rm Exh 0 0 Htg Cfm/SqFt 0.00 Fn BldTD 0.0 0.0 Total -530.0 Auxil 0 Htg Btuh/SqFt -36.56 Fn Frict

BUILDING U-VALUES - ALTERNATIVE 2 EFFICIENT WINDOWS - BLDG. 503

	Room U-Values (Btu/hr/sqft/F)										Room Mass	Room Capac.
Room				Summr	Wintr	, , ວຊ.		Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	0.310	0.318	0.358	0.000	48.3	9.66
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.184	0.310	0.318	0.358	0.000	99.8	20.85
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.184	0.310	0.318	0.358	0.000	74.0	15.25
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.184	0.310	0.318	0.358	0.000	74.0	15.25
Building	g ·	0.388	0.750	0.000	0.000	0.184	0.310	0.318	0.358	0.000	74.0	15.25

BUILDING AREAS - ALTERNATIVE 2
EFFICIENT WINDOWS - BLDG. 503

BUILDING AREAS-----

Room		Dupl	er of icate	Room	Total Floor Area	Partition Area	Exposed Floor Area	Skylight Area		Net Roof Area	Window Area	Win /Wl	Net Wall Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	1ST FLOOR	1	1	7,248	7,248	5,854	417	0	0.	0 ,	1,356	24	4,368
2	2ND FLOOR	1	1	7,248	7,248	5,854	0	0	0	7,248	1,356	24	4,368
Zone	1 Total/Ave				14,496	11,708	417	0	0	7,248	2,713	24	8,737
System	1 Total/Ave	•			14,496	11,708	417	0	0	7,248	2,713	24	8,737
Buildin	g				14,496	11,708	417	0	0	7,248	2,713	24	8,737

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

System Totals

Percent	Cool	ing Loa	d	Heatir	g Load	•••••	Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	. (%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-26,501	15	289	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-53,001	17	315	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-79,501	12	223	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-106,002	8	148	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-132,503	11	212	0.0	0	0	0.0	0	. 0
25 - 30	0.0	0	0	-159,003	12	219	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-185,504	8	155	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-212,004	7	128	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-238,505	9	177	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-265,005	1	10	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-291,506	0	0	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-318,006	0	0	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-344,507	0	0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-371,007	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-397,508	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-424,008	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-450,509	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-477,009	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-503,510	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-530,010	0	. 0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,884	0.0	0	8,760	0.0	0	8,760

1000000000000

------ MONTHLY ENERGY CONSUMPTION ---------

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	4,775	23	912	3
Feb	4,311	23	676	3
March	4,619	23	131	2
April	3,984	22	0	0
May	4,330	22	0	0
June	4,303	22	0	0
July	4,010	22	0	0
Aug	4,489	22	0	0
Sept	3,984	22	0	0
0ct	4,330	22	0	0
Nov	4,207	23	147	2
Dec	4,565	23	568	2
Total	51,907	23	2,433	3

Building Energy Consumption = Source Energy Consumption =

29,007 (Btu/Sq Ft/Year)
29,526 (Btu/Sq Ft/Year)

Floor Area =

14,496 (Sq Ft)

ESOS STUDY AT WSMR - BUILDING 504
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (ECO#9)

Weather File Code:	ELPASO	.w
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)

1313650

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

3.9171 (Lb-min./hr/cuft)

Enthalpy Factor:

Time/Date Program was Run: 17: 9:34 1/10/92 Dataset Name: 504 .TM

. 0

0

0.0

0.0

0.0

0.0

0.0

0.0

Return

Exhaust

Rm Exh

Auxil

0.0

0.0

0.0

-439.5

a soldinisting

Reheat

Humidif

Opt Vent

Total

System Block RAD - RADIATION Mo/Hr: 0/ 0 Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: 0 OADB: 24 Space Ret. Air Ret. Air Net Percnt * Space Percnt * Space Peak Coil Peak Sens.+Lat. Sensible Total Of Tot * Latent Sensible Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (%) * (Btuh) (Btuh) (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr 0 ٥ 0 0.00 0 0.00 0 ٥ 0.00 Skylite Cond 0 0 0 0.00 * 0 0.00 0 O 0.00 Roof Cond 0 0 0.00 0 0 0.00 * -48.568 -48,568 12.85 Glass Solar 0 0 ٥ 0.00 o 0.00 * 0 0 0.00 Glass Cond 0 0 0.00 0 O 0.00 * -121,587 -121,587 32.17 Wall Cond 0 0 0.00 0 0.00 -117,299 -117,299 31.03 Partition 0 ٥ 0.00 0.00 0 Ω 0.00 Exposed Floor 0 0.00 0 0.00 -12,185 -12,185 3.22 Infiltration 0.00 ٥ ٥ 0.00 -78,350 -78,350 20.73 Sub Total==> 0 a Ω 0.00 0.00 0 -377,989 -377,989 100.00 Internal Loads Lights 0 0 0 0.00 O 0.00 0 0.00 People 0 n 0.00 0 0.00 0 0.00 0 Misc ٥ 0 0 0.00 0.00 0 ٥ 0.00 Sub Total ==> 0 0 0 0.00 0 0.00 ٥ 0 0.00 Ceiling Load 0.00 0 0.00 ٥ 0 0.00 Outside Air 0 0.00 0.00 0 Sup. Fan Heat 0.00 0 0.00 0.00 Ret. Fan Heat O 0 0.00 0.00 0.00 Duct Heat Pkup 0 0 0.00 0.00 0.00 OV/UNDR Sizing 0 0.00 0 0.00 0 Ω Exhaust Heat 0 0.00 0.00 0 Terminal Bypass 0.00 0.00 0.00 Grand Total ==> 0 0 0.00 * 0.00 * -377,989 -377,989 100.00 -----COOLING COIL SELECTION----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 11,998 Main Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Part 9,412 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 369 Opt Vent 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 5,999 Totals 0.0 0.0 Wall 9,641 2,195 23 ------HEATING COIL SELECTION----------AIRFLOWS (cfm)-------ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Lvq Type Cooling Heating Clg % OA Clg 0.0 Type Htg (Mbh) (cfm) Deg F Deg F 0 Vent 0 Clg Cfm/Sqft 0.00 SADB 0.0 68.1 Main Htg -439.5 0 0.0 0.0 Infil 0 1,860 Clg Cfm/Ton 0.00 Plenum 0.0 68.0 Aux Hta 0.0 0 0.0 0.0 Supply 0 0 Clq Sqft/Ton 0.00 Return 0.0 68.0 Preheat 0.0 0 0.0 0.0 Mincfm 0 0 Cla Btuh/Saft 0.00 Ret/OA 0.0 68.0

0

0

0

0

.0

0

No. People

Htg Cfm/SqFt

Htg Btuh/SqFt

Htg % OA

0

0.0

0.00

-36.63

Runarnd

Fn MtrTD

Fn BldTD

Fn Frict

0.0

0.0

0.0

0.0

68.0

0.0

0.0

0.0

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BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 504

	Room U-Values										Room	Room
					(Btu	/hr/sqf	t/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST FLOOR	0.388	0.750	0.000	0.000	0.000	1.140	1.259	0.358	0.000	48.7	9.75
2	2ND FLOOR	0.388	0.000	0.000	0.000	0.184	1.140	1.259	0.358	0.000	100.2	20.94
Zone	<pre>1 Total/Ave.</pre>	0.388	0.750	0.000	0.000	0.184	1.140	1.259	0.358	0.000	74.5	15.34
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.184	1.140	1.259	0.358	0.000	74.5	15.34
Buildin	ıg	0.388	0.750	0.000	0.000	0.184	1.140	1.259	0.358	0.000	74.5	15.34

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 504

-BUILDING AREAS

				Floor	Total		Exposed						
		Numb	er of	Area/Dupl	Floor	Partition	Floor	Skylight	Skl	Net Roof	Window	Win	Net Wall
Room		Dupl	icate	Room	Area	Area	Area	Area	/Rf	Area	Area	/Wl	Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	1ST FLOOR	1	1	5,999	5,999	4,706	369	0	0	0	1,097	23	3,723
2	2ND FLOOR	1	1	5,999	5,999	4,706	0	0	0	5,999	1,097	23	3,723
Zone	1 Total/Ave	в.			11,998	9,412	369	0	0	5,999	2,195	23	7,447
System	1 Total/Ave	₽.			11,998	9,412	369	0	0	5,999	2,195	23	7,447
Buildin	g				11,998	9,412	369	0	0	5,999	2,195	23	7,447

V 600

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SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

System Totals

Percent	Cool	ing Loa	d	Heati	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-21,973	14	283	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-43,947	13	263	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-65,920	12	244	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-87,894	10	202	0.0	0	0	0.0	0	0
20 ~ 25	0.0	0	0	-109,867	10	199	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-131,841	8	160	0.0	0	0	0.0	0	. 0
30 - 35	0.0	0	0	-153,815	11	219	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-175,788	11	212	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-197,762	8	156	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-219,735	4	81	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-241,709	0	0	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-263,682	0	0	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-285,656	0	0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-307,629	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-329,603	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-351,576	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-373,550	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-395,523	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-417,497	0	0	0.0	. 0	0	0.0	0	0
95 - 100	0.0	0	0	-439,470	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,741	0.0	0	8,760	0.0	0	8,760

ommobilians:

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	4,065	19	876	3
Feb	3,653	19	668	3
March	3,870	19	157	2
April	3,297	18	0	0
May	3,584	18	0	0
June	3,562	18	0	0
July	3,319	18	0	0
Aug	3,716	18	0	0
Sept	3,297	18	0	0
Oct	3,584	18	0	0
Nov	3,616	19	149	2
Dec	3,877	19	561	3
Total	43,439	19	2,411	3

Building Energy Consumption = 32,451 (Btu/Sq Ft/Year)
Source Energy Consumption = 33,072 (Btu/Sq Ft/Year)

Floor Area = 11,998 (Sq Ft)



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Trane Air Conditioning Economics

By: Trane Customer Direct Service Network
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ESOS STUDY AT WSMR - BUILDING 504
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.

EFFICIENT WINDOWS: ALT 1-BSLN, ALT2-ECO (CLEAR) (ECO 49)

Weather File Code: ELPASO.W

Location:
Latitude: 31.0 (deg)
Longitude: 106.0 (deg)
Time Zone: 6

Elevation: 3,918 (ft)
Barometric Pressure: 25.8 (in. Hg)

Summer Clearness Number: 1.00
Winter Clearness Number: 1.00
Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:48:43 1/17/92 Dataset Name: 504 .TM Block

1

System

RAD

****	****	*** COOL	ING COIL	PEAK	*****	*****	*****	****	* CLG SPAC		**************************************			o/Hr: 13/ 1		
Peaked at Ti	me ==>		Mo/Hr:	0 \0				*		0/ 0 0	*			OADB: 24		
Dutside Air			WB/HR:	0/	0.0			*	OADB:	U	*					
butside Aii								*			ercnt *	Si	oace Peak	Coil Peak	Perc	nt
	9	Space	Ret. Air	Ref	t. Air	Net	Percnt	*	Space		Tot *		pace Sens	Tot Sens	of T	ot
	Sens.	•	Sensible	. 1	Latent	Total	Of Tot	*	Sensible	٠.	(%) *		(Btuh)	(Btuh)	((%)
Envelope Loa		Btuh)	(Btuh)		(Btuh)	(Btuh)	(%)	*	(Btuh) O		0.00 *		0	0	0.	.00
Skylite Sc		0	C	1		0	0.00		0		0.00	•	0	0	0.	.00
Skylite Co		0	()		0	0.00		-		0.00		-48,568	-48,568	17	.24
Roof Cond		0	()		0	0.00		. 0		0.00		0	0	0	.00
Glass Sol		0	()		0	0.00		0		0.00		-30,750	-30,750	10	.92
Glass Con		0	()		0	0.00				0.00		-117,299		41	.64
Wall Cond		0	1	0		0	0.00		(0.00		0	_	0	.00
Partition		0				0			(0.00		/ -12,185		4	.33
Exposed F		0				0			,)		· /	-72,865	•	25	.87
		ō				0)	0.00		-281,668		100	0.00
Infiltrat		0		0		0	0.00	0 *	1	0	0.00	-	-201,000	, 20.,		
Sub Total		•						*				-	() 0	. (00.0
Internal Lo	oacs	0		0		C	0.0	0 *		0	0.00			, 0		0.00
Lights		0		_		(0.0	0 *		0	0.00			,	1 (0.00
People		0		0	0	(0.0	0 *		0	0.00) (0.00
Misc	1	0		0	0	(0.0	0 *		0	0.00			0		0.00
Sub Tota		0		0		(0.0	0 *		0	0.00			0 (0.00
Ceiling Lo		0		0	0	1	0.0	00 *		0	0.00		•	•		2.00
Outside Ai		U		•			0.0	00 *			0.00	*			o (bo
Sup. Fan H				0			0.0	00 *			0.00	*			_	0.00
Ret. Fan H				0			0.0	00 *			0.00	*			0	0.00
Duct Heat		0		•			0.0	00 *		0	0.00	*		•	0	0.00
OV/UNDR ST		U		0	0		0 0.1	00 *			0.00	*			0	0.00
Exhaust He				0	0		0 0.	00 *			0.00	*			•	••••
Terminal i	Bypass			•				*				*	201 (68 -281,66	SR 11	00.00
	-1	0		0	0		0 0.	00 *		0	0.00	*	-281,6	- 201,00		
Grand Tot	a(==>	·		-										AREAS		
				COOLI	NG COIL SE	LECTION-						•	Gross Tot		(sf)	(%)
	Total Ca	nacity	Sens Ca		Coil Airfl	Ente	ring DB/				/WB/HR			11,998	, .	
	(Tons)	(Mbh)	(Mbh)		(cfm)	Deg F	Deg F (Grains	=		Grains		Part	9,412		
	0.0	0.0	0.		0	0.0	0.0	0.0	0.0	0.0	0.0		rairt Exflr	369		
Main Clg	0.0	0.0	0.		0	0.0	0.0	0.0	0.0	0.0	0.0		-	5,999	(0
Aux Clg	0.0	0.0	0.		0	0.0	0.0	0.0	0.0	0.0	0.0		Roof Wall	9,641	2,19	5 23
Opt Vent	0.0	0.0											Watt	,,041	-,	
Totals	0.0	•••											ruerve	TEMPERAT	URES	(F)
	WEATING	COIL SE	LECTION-	. 			AIRFLOW	S (cfm)			(ING	CHECKS	Type	Clg	Htg
200000	Capacity			nt	Lvg	Type	Cool	ing	Heating		% OA	_4.	0.00	SADB	0.0	68.1
	(Mbh)			eg F	Deg F	Vent		0	0		cfm/S		0.00	Plenum	0.0	68.0
Main H4-	-439.5		0	0.0	0.0	Infil		0	1,730		g Cfm/T		0.00	Return	0.0	68.0
Main Htg	0.0		0	0.0	0.0	Supply		0	0		g Sqft/			Ret/OA	0.0	68.0
Aux Htg	0.0		0	0.0	0.0	Mincfm		0	0		g Btuh/		0.00	Runarnd	0.0	68.
Preheat	0.0		0	0.0	0.0	Return		0	0		. Peopl	e		Fn MtrTD	0.0	0.0
Reheat	0.0		0	0.0		Exhaust		0	0		g % OA		0.0	Fn BldTD	0.0	0.
Humidif			ō	0.0		Rm Exh		0	0		g Cfm/S		0.00	fn frict	0.0	
Opt Vent	-439.		*			Auxil		0	0	H1	g Btuh,	sqft	-36.63	THE TELES	3.3	
Total	-437.	,													4	

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

BUILDING U-VALUES - ALTERNATIVE 2 EFFICIENT WINDOWS - BLDG. 504

BUILDING U-VALUES-----

												Room Capac. (Btu/
Room	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	(lb/ sqft)	sqft/F)
1 2 Zone System Buildir	1ST FLOOR 2ND FLOOR 1 Total/Ave. 1 Total/Ave.	0.388 0.388 0.388	0.000 0.750 0.750	0.000 0.000 0.000	0.000	0.184 0.184 0.184	0.310 0.310 0.310	0.318	0.358 0.358 0.358	0.000	48.7 100.2 74.5 74.5 74.5	9.75 20.94 15.34 15.34 15.34

BUILDING AREAS - ALTERNATIVE 2 EFFICIENT WINDOWS - BLDG. 504

BUILDING AREAS-----

Room		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition , Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)		Net Roof Area (sqft)	Window Area (sqft)	/WL	Net Wall Area (sqft)
Number 1 2 Zone System Buildir	1 1	1	5,999 5,999	5,999 5,999 11,998 11,998 11,998	9,412	369 0 369 369 369	0 0 0 0	0	0 5,999 5,999 5,999 5,999	1,097 1,097 2,195 2,195 2,195	23 23	3,723 3,723 7,447 7,447 7,447

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

SYSTEM LOAD PROFILE -----

System Totals

Percent	Cool	ing Load	<u> </u>	Heatir	ng Load -		Cooling				Airflow	
Design	Cap.		Hours	Capacity	Hours	Hours	Cap.		Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-21,973	14	259	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-43,947	16	291	0.0	0	0	0.0	0	0
10 - 15	0.0	٥	0	-65,920	12	222	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-87,894	8	137	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-109,867	14	244	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-131,841	11	197	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-153,815	7	132	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-175,788	7	128	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-197,762	10	177	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-219,735	1	10	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-241,709	0	0	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-263,682	0	0	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-285,656	0	0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-307,629	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-329,603	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-351,576	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-373,550	0	0	0.0	0	0	0.0	0	=
85 - 90	0.0	0	0	-395,523	0	0	0.0	0	0	0.0	0	
90 - 95	0.0	0	0	-417,497	0	0	0.0	0		0.0		-
95 - 100	0.0	0	0	-439,470	0	0	0.0	0		0.0		
Hours Off		0	8,760	0	0	6,963	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	4,035	19	743	3
Feb	3,616	19	552	2
March	3,828	19	103	2
April	3,297	18	0	0
May	3,584	18	0	0
June	3,562	18	0	0
July	3,319	18	0	0
Aug	3,716	18	0	0
Sept	3,297	18	0	0
Oct	3,584	18	0	0
Nov	3,581	19	107	2
Dec	3,731	19	453	2
Total	43,149	19	1,958	3

Building Energy Consumption = Source Energy Consumption = 28,596 (Btu/Sq Ft/Year) 29,100 (Btu/Sq Ft/Year) Floor Area = 11,998 (Sq Ft)

D3-200

	LC	CATION: Whi	te Sands Missile	Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				-ELECTRIC DHW HEA	TERS		FISCAL YEAR:	1992
	DI	SCRETE PORTI	ON NAME:	TOTAL				
	٨N	IALYSIS DATE:	06/04/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1 I	NVES	TMENT						
		ONSTRUCTION	COST	=			\$7,820	
		OH COST		(5.5% of 1A) =			\$430	
		SIGN COST		(6.0% of 1A) =			\$469	
		ERGY CREDIT		(1A + 1B + 1C) =			\$8,719	
		LVAGE VALUE	-117	#D 4D			\$0	•• ••
,	10	OTAL INVESTME	EN I	(1D - 1E) =			 >	\$8,719
2 E	ENER	GY SAVINGS (+)	/COST (-)					
	FU	JEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
,	. EL	.EC	\$6.48	(15)	(\$98)	15.23	(\$1,489)	
Ε	3. DI	ST		0	\$0	17.28	\$0	
C). NA	AT GAS	\$2.21	49	\$108	19.64	\$2,112	
). PA	PER		0	\$0		\$0	
E	E. CC	DAL			\$0	16.22	\$0	
F	. TO	TAL		34	9.8		 >	\$623
	ION I	ENEDOV GAVIN	100 (1) 1000T (_			
		ENEHGT SAVIN INUAL RECURF	IGS (+) / COST (- PING (+/-)	•)			••	
•		DISCOUNT FAC	• •		(From Table A-2) =	14.68	\$0	
			SAVINGS (+) / CC)ST (-)	$(3A \times 3A1) =$	14.00	\$0	
Ε		ON-RECURRING			(OAX OA)		Ψ	
		ГЕМ	` '		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
	a.			\$0		0.00	\$0	
	b.	•		\$0		0.00	\$0	
	c.			\$0		0.00	\$0	
		TOTAL		\$0			\$0	
				ED SAVINGS (+) / COS	FT (-)	(3A2 + 3Bd4) =		\$0
		ROJECT NON-E						
		25% MAXIMUM 1. IF 3D1 => 3C ⁻	NON-ENERGY	CALCULATION	•	(2F5 x 0.33) =	\$206	
			HEN GO 10 4 HEN CALCULAT	E CID		/0FF - 0D4) / 4F		
		: IF 3D1 < 30 11		ESIN		(2F5 + 3D1) / 1F =		
				OES NOT QUALIFY				
				OLD HOT WONLIFT				
4 F	IRST	YEAR DOLLAR	SAVINGS (+) / C	OSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$10
5 T	OTAL	NET DISCOUN	ITED SAVINGS			(2F5 + 3C) =		\$623
6 [osco	UNTED SAVING	3S-TO-INVEST	MENT RATIO (SIR)		(5/1F) =		0.07
	(IF SI	R < 1 THEN PR	OJECT DOES NO	OT QUALIFY)				
7 8	IMPL	E PAYBACK (SF	PB)			(1F/4) =		891.61

								•
		LOCATION: Whit	te Sands Missil	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	ECO #10-P1	24-ELECTRIC DHW HEA	TERS		FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/15/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	iN۱	/ESTMENT						
	A.	CONSTRUCTION	COST	=			\$16,158	
	В.	SIOH COST		(5.5% of 1A) =			\$889	
	C.	DESIGN COST		(6.0% of 1A) =			\$969	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$18,016	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			 >	\$18,016
2	EN	ERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
		ELEC	\$6.48	(14)	(\$92)	15.2 3	(\$1,400)	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	50	\$111	19.64	\$2,187	
		PAPER		0	\$0		\$0	
		COAL		0	\$0	16.22	\$0	
	F.	TOTAL		36	19.4		>	\$787
3	NO	N-ENERGY SAVIN	GS (+) / COST.	(-)				
•		ANNUAL RECURR	• •	(-7	_		\$0	
		1 DISCOUNT FAC			(From Table A-2) =	14.68	•	
		2 DISCOUNTED S		OST (-)	(3A x 3A1) =	14.00	\$0	
	В.	NON-RECURRING	, ,		(ON X ON I) =		•	
		ITEM	- (.,)		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0	0000111121102 (2)	0.00	\$0	
		b.		\$0		0.00	\$0	
		с.		\$0		0.00	\$0	
		d TOTAL		\$0		0.00	\$0	
	C.		RGY DISCOUN	ITED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =	40	\$0
		PROJECT NON-E			. ()	(6/2 / 654)		40
		1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$260	
		a IF 3D1 => 3C T				(2, 0 x 0.00) =	\$255	,
		b IF 3D1 < 3C TH				(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T				(210.051)		
				DOES NOT QUALIFY				
4	FIR	ST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$19
		TAL NET DISCOUN				(2F5 + 3C) =		\$7 87
6	DIS	COUNTED SAVING	S-TO-INVEST	TMENT RATIO (SIR)		(5/1F) ≈		0.04
	(IF	SIR < 1 THEN PRO	DJECT DOES N	IOT QUALIFY)				
7	SIN	IPLE PAYBACK (SP	B)			(1F/4) =		927.37

	LOCATION	White Sands Miss	ilo Banco	DECION:		DDO IFOT NO.	5.6. 6. 6. 6. 6.
			•	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		RTION NAME:	153-ELECTRIC DHW HEA TOTAL	HEHS		FISCAL YEAR:	1992
	ANALYSIS DA			ECONOMIC LIFE:	25	DDEDADED BY:	A. STOVER
	ANAL 1 313 DA	12. 00/04/92	•	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVEN
1 11	NVESTMENT						
A	. CONSTRUCTI	ON COST				\$2,314	
8	. SIOH COST		(5.5% of 1A) =			\$127	
C	. DESIGN COST	г	(6.0% of 1A) =			\$139	
D	. ENERGY CRE	DIT	(1A + 1B + 1C) =			\$2,580	
E	. SALVAGE VAL	.UE	=			\$0	
F	. TOTAL INVES	TMENT	(1D - 1E) =			>	\$2,580
2 E	NERGY SAVING	S (+) / COST (-)					
	FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
		\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	. ELEC	\$6.48	3 (3)	(\$18)	15.23	(\$273)	
В	. DIST		0	\$0	17.28	\$0	
	. NAT GAS	\$2.2	13	\$29	19.64	\$561	
_	. PAPER		0	\$0		\$0	
	. COAL			\$0	16.22	\$0	
F	. TOTAL		10	10.6		 >	\$288
2 N	ON ENERGY OF	V(NCC (+) / COC	F/\				
		VINGS (+) / COS	· (-)				
^	. ANNUAL REC 1 DISCOUNT	, ,		/C T-blo 4 0)	44.00	\$0	
		FACTOR ED SAVINGS (+) /	COST ()	(From Table A-2) =	14.68	**	
В	. NON-RECUR		COST (-)	(3A x 3A1) =		\$0	
	ITEM	AII (47-4)		YEAR OF	DISCOUNT	DISCOUNTED	•
			SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
	a.		\$0	0000111121102 (2)	0.00	\$0	
	b.		\$0		0.00	\$0	
	c.		\$0		0.00	\$0	
	d TOTAL		\$0		0.00	\$0	
С	_	ENERGY DISCOL	INTED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =	4.5	\$0
		N-ENERGY TEST			(0/12 : 0504)		
			SY CALCULATION		(2F5 x 0.33) =	\$95	
		3C THEN GO TO			(2. 0 % 0.00)	400	
	b IF 3D1 < 3	C THEN CALCUL	ATE SIR		(2F5 + 3D1) / 1F =		
	c IF 3D1b =:	> 1 THEN GO TO	4			· ·	
	d IF 3D1b <	1 THEN PROJEC	T DOES NOT QUALIFY				
4 F	IRST YEAR DOLI	LAR SAVINGS (+)	/ COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$11
5 T	OTAL NET DISC	DUNTED SAVING	is	•	(2F5 + 3C) =		\$288
6 D	ISCOUNTED SA	VINGS-TO-INVE	STMENT RATIO (SIR)		(5/1F) =		0.11
	(IF SIR < 1 THEN	PROJECT DOES	NOT QUALIFY)				
7 S	IMPLE PAYBACK	((SPB)			(1F/4) =		243.13

		LOCATION: Whit		•	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	ECO #10-P2	54-ELECTRIC DHW HEA	TERS		FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/04/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IN۱	/ESTMENT						
	A.	CONSTRUCTION	COST	•			\$4,628	
	В.	SIOH COST		(5.5% of 1A) =			\$255	
	C.	DESIGN COST		(6.0% of 1A) =			\$278	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$5,160	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	ENT	(1D - 1E) =			>	\$5,160
_								
2	EN	ERGY SAVINGS (+)	• •					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$		DISCOUNTED	
	_		\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)		SAVINGS (5)	
		ELEC	\$6.48	(7)			(\$714)	
		DIST		0	\$0		\$0	
			\$2.21		\$57	19.64	\$1,112	
	-	PAPER		0	\$0		\$0	
		COAL			\$0		\$0	
	F.	TOTAL		18	9.8		 >	\$398
3	NO	N-ENERGY SAVIN	GS (+) / COST	(-)				
	A.	ANNUAL RECURP	RING (+/-)		=		\$0	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	AVINGS (+) / C	OST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRING	3 (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENE	RGY DISCOUN	ITED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$0
	D.	PROJECT NON-E	NERGY TEST					
		1 25% MAXIMUM	NON-ENERGY	Y CALCULATION		(2F5 x 0.33) =	\$131	
		a IF 3D1 => 3C 1	THEN GO TO 4					
		b IF 3D1 < 3C TH	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T	HEN GO TO 4					·
		d IF 3D1b < 1 Th	IEN PROJECT	DOES NOT QUALIFY				,
A	FIE	RST YEAR DOLLAR	SAVINGS (+) (COSTS (-)	/0E6	1 + 2 A + (2D14/05)\		01 A
		TAL NET DISCOUN		• •	(2F3	3 + 3A + (3B1d/25)) = (2F5 + 3C) =		\$10 \$398
				TMENT RATIO (SIR)				\$398 0.08
,		SIR < 1 THEN PRO				(5/1F) =		0.08
7		MPLE PAYBACK (SP		TOT QUALIFT)		/4E/A\		FAA 46
•	OW	WILE FAIDAUR (SP	<i>-,</i>			(1F/4) =		529.16

		LOCATION: Whit	a Sanda Missila D	200	RECION	•	BBO IECT NO.	2000 00 00 00 00
				elige ELECTRIC DHW HEA	REGION:	4	PROJECT NO: FISCAL YEAR:	DACA 63-91-C-0152 1992
		DISCRETE PORTIO		TAL			TIOOAE TEAM.	1992
		ANALYSIS DATE:	06/04/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IN۱	/ESTMENT						
	A.	CONSTRUCTION	COST	=			\$3,830	
		SIOH COST		(5.5% of 1A) =			\$211	
		DESIGN COST		(6.0% of 1A) =			\$230	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$4,270	
		SALVAGE VALUE TOTAL INVESTME	:NT	(1D - 1E) =			\$0	****
	• •	TOTAL INVESTIGE		(10 - 12) =			>	\$4,270
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	(5)	(\$35)	15.23	(\$533)	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	17	\$38	19.64	\$747	
		PAPER		0	\$0		\$0	
		COAL			\$0	16.22	\$0	
	F.	TOTAL		12	3.1		>	\$215
3	NO	N-ENERGY SAVIN	GS (+) / COST (-)					
·		ANNUAL RECURR			*		\$0	
		1 DISCOUNT FAC	• •		(From Table A-2) =	14.68	4-	
		2 DISCOUNTED S	AVINGS (+) / COS	T ()	(3A x 3A1) =		\$0	
	B.	NON-RECURRING	à (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	QCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c. d TOTAL		\$0 \$0		0.00	\$0	
	C.		RGY DISCOUNTE	D SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =	\$0	\$0
		PROJECT NON-EI			. ()	(0/12 1 0504) =		Ψ.
		1 25% MAXIMUM	NON-ENERGY CA	ALCULATION		(2F5 x 0.33) =	\$71	
		a IF 3D1 => 3C T	HEN GO TO 4					
		b IF 3D1 < 3C TH	IEN CALCULATE	SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T					•	
		d IF 3D1b < 1 TH	IEN PROJECT DO	ES NOT QUALIFY				
A	ÉID	ST VEAR DOLLAR	SAVINGS (A LCC)	ete ()	/APA	. 04 . (004 - 100)	•	•-
		IST YEAR DOLLAR TAL NET DISCOUN		515(-)	(2F3	+ 3A + (3B1d/25)) =		\$3 *01 <i>E</i>
		COUNTED SAVING		ENT RATIO (SIR)		(2F5 + 3C) = (5/1F) =		\$215 0.05
-		SIR < 1 THEN PRO		• • •		(5/11)=		0.05
7		MPLE PAYBACK (SP		,		(1F/4) =		1382.79
						, ,		

		LOCATION: Whi	ta Sande Miceil	- Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				CTRIC DHW HEATERS		₹	FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/09/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IN۱	/ESTMENT						
		CONSTRUCTION	COST	=			\$20,82 6	
		SIOH COST		(5.5% of 1A) =			\$1,145	
		DESIGN COST ENERGY CREDIT		(6.0% of 1A) =			\$1,250	
		SALVAGE VALUE		(1A + 1B + 1C) =			\$23,221	
		TOTAL INVESTME	:NT	(1D – 1E) =			\$0	\$00.004
	••	TOTAL III VEOTIME		(10 - 12) -				\$23,221
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	(38)	(\$244)	15.23	(\$3,711)	
	В.	DIST		0	\$0	17.28	\$0	
		NAT GAS	\$2.21	116	\$257	19.64	\$5,053	
		PAPER		0	\$0		\$0	
		COAL			\$0	16.22	\$0	
	г.	TOTAL		79	13.6		>	\$1,342
3	NO	N-ENERGY SAVIN	GS (+) / COST (-)				
		ANNUAL RECURP		,	=		\$0	
		1 DISCOUNT FAC			(From Table A-2) =	14.68	**	
		2 DISCOUNTED S	AVINGS (+) / CO	OST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRING	G (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c. d TOTAL		\$0		0.00	\$0	
	С		RGY DISCOLIN	\$0 TED SAVINGS (+) / COS	T (_)	(2A2 + 2Pd4) -	\$0	••
		PROJECT NON-E		125 OATHIGG (7)1 003	· (-)	(3A2 + 3Bd4) =		\$0
		1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$443	
		a IF 3D1 => 3C T	HEN GO TO 4			(2. 5 % 5.55)	VS	
		b IF 3D1 < 3C TH	IEN CALCULAT	TE SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T	HEN GO TO 4		•	•		
		d IF 3D1b < 1 TH	IEN PROJECT (DOES NOT QUALIFY				
4	EID	OT VEAD DOLL 40	CAVINO CO (C) (C)	20070 /)	 -			
		IST YEAR DOLLAR TAL NET DISCOUN		JUS18 (-)	(2F3 ·	+ 3A + (3B1d/25)) =		\$14
		COUNTED SAVING		MENT RATIO (SIR)	•	(2F5 + 3C) = (5/1F) =		\$1,342
-		SIR < 1 THEN PRO	••	• •		(3/1F) =		0.0€
7		IPLE PAYBACK (SP		- ,		(1F/4) =		1704.07
		• • • • • • • • • • • • • • • • • • • •	-			,,-		1147.41

		/hite Sands Missi	-	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
			880-ELECTRIC DHW HEA	TERS		FISCAL YEAR:	1992
	DISCRETE POR		TOTAL				
	ANALYSIS DAT	E: 06/04/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1 11	IVESTMENT						
	. CONSTRUCTIO	N COST	_	:		\$7.620	
	. SIOH COST		(5.5% of 1A) =			\$419	
	. DESIGN COST		(6.0% of 1A) =			\$457	
	. ENERGY CRED	IT	(1A+1B+1C)=			\$8,496	
	. SALVAGE VALU		(18+18+10)=			\$0,450	
	. TOTAL INVEST		(1D – 1E) =			 >	\$8,496
•			(15 12)				40,450
2 E	NERGY SAVINGS	(+) / COST (-)					
	FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
		\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
A	ELEC	\$6.48	(1)	(\$6)	15.23	(\$91)	
В	. DIST		0	\$0	17.28	\$0	
С	. NAT GAS	\$2.21	12	\$27	19.64	\$533	
Đ	. PAPER		0	\$0		\$0	
Ε	. COAL			\$0	16.22	\$0	
F.	TOTAL		11	21.2		>	\$443
	ON-ENERGY SAV		· (-)				
Α.	. ANNUAL RECU	• •		=		\$0	
	1 DISCOUNT F			(From Table A-2) ≈	14.68		
_		O SAVINGS (+) / (COST (-)	(3A x 3A1) =		\$0	
В.	NON-RECURRI	NG (+/-)					
	ITEM		641/1146 6 / 11	YEAR OF	DISCOUNT	DISCOUNTED	
			SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
	a.		\$0		0.00	\$0	
	b.		\$0		0.00	\$0	
	c. d Total		\$0		0.00	\$0	
c		NEBGA DISCOM	\$0 NTED SAVINGS (+) / COS	T/\	(040 - 0544)	\$0	••
	. PROJECT NON-			· (-)	(3A2 + 3Bd4) =		\$0
			Y CALCULATION		(2F5 x 0.33) =	\$146	
		C THEN GO TO			(21 5 x 0.55) =	\$140	
		THEN CALCULA			(2F5 + 3D1) / 1F =		
		1 THEN GO TO 4			(2137301)711 =		
			DOES NOT QUALIFY				
			·				
4 Fi	RST YEAR DOLLA	AR SAVINGS (+)	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$21
5 T	OTAL NET DISCO	UNTED SAVINGS	S		(2F5 + 3C) =		\$443
6 D	ISCOUNTED SAVI	NGS-TO-INVES	TMENT RATIO (SIR)		(5/1F) =		0.05
(IF SIR < 1 THEN P	PROJECT DOES	NOT QUALIFY)				

		LOCATION: Wh	ite Sands Missil	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				64-ELECTRIC DHW HEA		•	FISCAL YEAR:	1992
		DISCRETE PORT		TOTAL				
		ANALYSIS DATE:			ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IN	VESTMENT						
	A.	CONSTRUCTION	COST	=			\$4,588	
	В.	SIOH COST		(5.5% of 1A) =			\$252	
	C.	DESIGN COST		(6.0% of 1A) =			\$275	
	D.	ENERGY CREDIT	•	(1A + 1B + 1C) =			\$5,116	
	E.	SALVAGE VALUE	į				\$0	
	F.	TOTAL INVESTM	ENT	(1D - 1E) =			>	\$5 ,116
2	EN	IERGY SAVINGS (+	-) / COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	(6)	(\$42)	15.23	(\$638)	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	16	\$34	19.64	\$675	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		9	(7.5)		>	\$37
3	NC	ON-ENERGY SAVII	NGS (+) / COST	(-)				
	A.	ANNUAL RECUR	RING (+/-)		=		\$0	
		1 DISCOUNT FA	CTOR		(From Table A-2) =	14.68		
		2 DISCOUNTED	SAVINGS (+) / C	COST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRIN	IG (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
	_	d TOTAL		\$0			\$0	
				NTED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$0
	D.	PROJECT NON-I	-				_	
		1 25% MAXIMUN				(2F5 x 0.33) =	\$12	
		a IF 3D1 => 3C						
		b IF 3D1 < 3C T				(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1						
		d IF 3D1b < 1 T	HEN PROJECT	DOES NOT QUALIFY				
4	FIF	RST YEAR DOLLAF	R SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		(\$8)
		TAL NET DISCOU			ζ σ	(2F5 + 3C) =		\$ 37
				TMENT RATIO (SIR)		(5/1F) =		0.01
		F SIR < 1 THEN PF		, ,		(/		
7		MPLE PAYBACK (S		•		(1F/4) =		-68 1.79
		•	•			, ,		•

		LOCATION: Whit		Range 04-ELECTRIC DHW HE	REGION:	4	PROJECT NO: FISCAL YEAR:	DACA 63-91-C-0152 1992
		DISCRETE PORTIC	ON NAME: 06/04/92	TOTAL	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	INN	/ESTMENT						
•		CONSTRUCTION	COST	_			\$3,830	
		SIOH COST	•••	(5.5% of 1A) =			\$211	•
		DESIGN COST		(6.0% of 1A) =			\$230	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$4,270	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$4,270
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	(15)	(\$100)	15.23	(\$1,520)	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	43,	\$95	19.64	\$1,875	
	D.	PAPER		0	\$0	•	\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		28	(4.3)		>	\$356
3	NO	N-ENERGY SAVIN	GS (+) / COST (-	-)				
	A.	ANNUAL RECURR	ING (+/-)				\$0	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	AVINGS (+) / CO	OST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRING	3 (+/ -)				٠	
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a .		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		C.		. \$0		0.00	\$0	
	_	d TOTAL NON ENE	DOV DISCOUNT	\$0	T/>	(0.4.6	\$0	
		PROJECT NON-E		TED SAVINGS (+) / COS	·	(3A2 + 3Bd4) =		\$0
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$117	
		a IF 3D1 => 3C 1				(2. 6 % 5.06)	4	
		b IF 3D1 < 3C TH	HEN CALCULAT	E SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T	HEN GO TO 4				•	•
		d IF 3D1b < 1 Th	IEN PROJECT [DOES NOT QUALIFY				
4	FIR	RST YEAR DOLLAR	SAVINGS (+) / C	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		(\$4)
5	TO	TAL NET DISCOUN	TED SAVINGS			(2F5 + 3C) =		\$356
6	DIS	SCOUNTED SAVING	S-TO-INVEST	MENT RATIO (SIR)		(5/1F) =		0.08
	(IF	SIR < 1 THEN PRO	DJECT DOES N	OT QUALIFY)				
7	SIM	MPLE PAYBACK (SP	B)			(1F/4) =		-995.72

		White Sands Missi	•	REGION:	4	PROJECT NO:	DACA 63-91-C-0152	
	PROJECT TI	TLE: ECO #10-P1	506-ELECTRIC DHW HE	ATERS		FISCAL YEAR:	1992	
	DISCRETE F	ORTION NAME:	TOTAL					
	ANALYSIS D	ATE: 06/04/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER	
1 11	NVESTMENT							
	. CONSTRUC	TION COST	_			. \$9,176		
	. SIOH COST		(5.5% of 1A) =			\$505		
_	DESIGN CO	eT .	(6.0% of 1A) =			\$551		
-	ENERGY CF		(1A + 1B + 1C) =			\$10,231		
_	SALVAGE V		(17 + 15 + 10) =			\$0		
			4D 4E -			 >	\$10,231	
	. TOTAL INVE	SIMENI	(1D – 1E) =				\$10,231	
2 E	NERGY SAVIN	GS (+) / COST (-)						
	FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED		
		\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)		
A	. ELEC	\$6.48	(20)	(\$129) 15.23	(\$1,962)	1	
В	. DIST		0	\$0	17.28	\$0		
C	. NAT GAS	\$2.21	106	\$235	19.64	\$4,615		
D	. PAPER		0	\$0	•	\$0		
E	. COAL			\$0	16.22	\$0		
F	. TOTAL		86	106.1		 >	\$2,652	
2 h	ION ENERGY	SAVINGS (+) / COST						
			(-)	_		\$0		
^		CURRING (+/-)		= (From Table A-2) =	14.68	40		
	1 DISCOUN	TED SAVINGS (+) / (COST ()	-		\$0		
	2 DISCOUN B. NON-RECU		2051 (-)	(3A x 3A1) =		40		
-	ITEM	HAING (+/-)		YEAR OF	DISCOUNT	DISCOUNTED		
	I I EIM		CANUNCE (1)					
	_		SAVINGS (1) \$0	OCCURRENCE (2)	0.00	\$0		
	a. L		·			•		
	b.		\$0		0.00	\$0		
	C.	•	\$0		0.00	\$0		
_	d TOTAL	L ENEDOV DIOGOLI	\$0 NTED 04//NO0/// / 000	· ·	(040 - 0544)	\$0	**	
			NTED SAVINGS (+) / COS) (-)	(3A2 + 3Bd4) =		\$0	
L		ON-ENERGY TEST	V 0 11 0 111 1 T 10 11		(055 0.00)	4075		
		IMUM NON-ENERG			(2F5 x 0.33) =	\$875		
		> 3C THEN GO TO			(055 . 054) / 45			
		3C THEN CALCUL			(2F5 + 3D1) / 1F =		•	
		=> 1 THEN GO TO 4				-		
	d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY							
4 F	IRST YEAR DO	LLAR SAVINGS (+)	COSTS (-)	(2F3	3 + 3A + (3B1d/25)) =		\$106	
5 T	TOTAL NET DISCOUNTED SAVINGS			·	(2F5 + 3C) =		\$2,652	
6 C	SCOUNTED S	AVINGS-TO-INVES	STMENT RATIO (SIR)		(5/1F) =		0.26	
		N PROJECT DOES	, ,					
	MADLE DAVOA				(4E(A) -		00.40	

(1F/4) =

96.43

7 SIMPLE PAYBACK (SPB)

		LOCATION: Whit		-	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				12-ELECTRIC DHW HE	ATERS		FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/04/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
						•		
1		/ESTMENT						
		CONSTRUCTION	COST				\$8,458	
	В.			(5.5% of 1A) =			\$465	
	C.	DESIGN COST		(6.0% of 1A) =			\$507	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$9,431	
	E.		·· ·=				\$0	
	F.	TOTAL INVESTME	INT	(1D - 1E) =			 >	\$9 ,431
•	=N	ERGY SAVINGS (+)	/COST/ \					
-	,	FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
		. 022 2	\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)			
	A.	ELEC	\$6.48		\$AVINGS (3) (\$17)	FACTOR (4) 15.23	SAVINGS (5) (\$258)	
		DIST	40.70	(3) 0	(\$17) \$0	17.28	(\$258) \$0	
		NAT GAS	\$2.21	40	\$89	19.64	\$1,739	
		PAPER	V ·	0	\$0 \$0	13.04	\$0	
	E.	COAL		•	\$0	16.22	\$0	
	F.	TOTAL		37	71.6		>	\$1,480
				-				\$1,400
3	NO	N-ENERGY SAVIN	GS (+) / COST ((-)				
	A.	ANNUAL RECURR	ING (+/-)		=		\$0	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	AVINGS (+) / C	OST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRING	i (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	•
		d TOTAL		\$0			\$0	
				TED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$0
	D.	PROJECT NON-E						
		1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$48 8	
		a IF 3D1 => 3C T						
		b IF 3D1 < 3C TH		TE SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T						
		a 11-3016<1Th	IEN PROJECT	DOES NOT QUALIFY				
4	FIR	ST YEAR DOLLAR	SAVINGS (+) / (COSTS (-)	(2E2	+ 3A + (3B1d/25)) =		\$ 72
		TAL NET DISCOUN		/	613)	(2F5 + 3C) =		\$1,480
				MENT RATIO (SIR)		(5/1F) =		0.16
		SIR < 1 THEN PRO				(5, 11) =		0.10
7		MPLE PAYBACK (SP		•		(1F/4) =		131.80
			•			(1) 17) =		131.60

		LOCATION: Whit		Range 8-ELECTRIC DHW HE	REGION: ATERS	4	PROJECT NO: FISCAL YEAR:	DACA 63-91-C-0152 1992
		ANALYSIS DATE:	ON NAME: T 06/04/92	OTAL	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	iN۱	/ESTMENT						
		CONSTRUCTION	COST	=			\$6,104	
	В.	SIOH COST		(5.5% of 1A) =			\$336	
	C.	DESIGN COST		(6.0% of 1A) =			\$366	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$6,806	
	E.	SALVAGE VALUE		-			\$0	
	F.	TOTAL INVESTME	NT	(1D – 1E) =			>	\$6,806
2	EN	ERGY SAVINGS (+)	/ COST (-)					
Ī		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	(15)	(\$100)	15.23	(\$1,520)	
	В.	DIST		0	\$0	17.28	\$0	·
	C.	NAT GAS	\$2.21	22	\$49	19.64	\$960	
	D.	PAPER		O.	\$0		\$0	
		COAL			\$0	16.22	\$0	
	F.	TOTAL		7	(50.9)		>	(\$559)
3	NO	N-ENERGY SAVIN	GS (+) / COST (-)	ı				
		ANNUAL RECURP					\$0	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	SAVINGS (+) / CO	ST (-)	(3A x 3A1) =		\$0	
	B.	NON-RECURRING	3 (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0 \$0		0.00	\$0	
		c. d TOTAL		\$0 \$0		0.00	\$0 •n	
	C.		RGY DISCOUNTI	ED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =	\$0	\$0
		PROJECT NON-E			. ()	(6.2 : 622.4)		**
		1 25% MAXIMUM	NON-ENERGY C	CALCULATION		(2F5 x 0.33) =	(\$185)	-
		a IF 3D1 => 3C 1	THEN GO TO 4			•		
		b IF 3D1 < 3C TH	HEN CALCULATE	SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T						
		d IF 3D1b < 1 Th	HEN PROJECT DO	DES NOT QUALIFY				•
4	FIR	ST YEAR DOLLAR	SAVINGS (+) / CO	OSTS (-)	(2F3 ·	+ 3A + (3B1d/25)) =		(\$51)
		TAL NET DISCOUN			•	(2F5 + 3C) =		(\$559)
6	DIS	COUNTED SAVING	SS-TO-INVESTM	ENT RATIO (SIR)		(5/1F) =		-0.08
	(IF	SIR < 1 THEN PRO	DJECT DOES NO	T QUALIFY)				
7	SIM	IPLE PAYBACK (SP	PB)			(1F/4) =		-133.75

PROJECT TITLE: ECO #10-P1S28-ELECTRIC DHW HEATERS FISCAL YEAR: 1992 1993 1			LOCATION: White	e Sands Missil	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
INVESTMENT					_	ATERS		FISCAL YEAR:	1992
1 INVESTMENT A. CONSTRUCTION COST B. SICH COST (5.5% of 1A) = \$343 C. DESIGN COST (6.0% of 1A) = \$343 C. DESIGN COST (6.0% of 1A) = \$374 D. ENERGY CREDIT (1A+1B+1C) = \$30,951 E. SALVAGE VALUE F. TOTAL INVESTMENT (1D−1E) = \$30,951 2 ENERGY SAVINGS (+) COST (-) FUEL TYPE FUEL COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED SAVINGS (-) FUEL TYPE FUEL COST SAVINGS (-) A. ELEC \$38.48 (15) (\$100) 15.23 (\$1.520) B. DIST 0 \$50 17.28 \$50 C. NAT GAS \$2.21 49 \$106 19.54 \$2.119 D. PAPER 0 \$50 17.28 \$50 E. COAL \$30 18.22 \$50 F. TOTAL 3 33 8.1 → \$599 3 NON-ENERGY SAVINGS (+) COST (-) A. ANNUAL RECURRING (+) (From Table A-2) = 14.68 2 DISCOUNTED SAVINGS (+) COST (-) A. ANNUAL RECURRING (+) (From Table A-2) = 14.68 2 DISCOUNTED SAVINGS (+) COST (-) B. MON-RECURRING (+) (From Table A-2) = 14.68 3 O. 0.0 5 D. \$50 0.00 \$50 b. \$50 0.00 \$50 c. \$50			DISCRETE PORTIC	ON NAME:	TOTAL				
A. CONSTRUCTION COST B. SICH COST (6.5% of 1A) = \$343 C. DESIGN COST (8.0% of 1A) = \$3574 D. ENERGY CREDIT (1A + 1B + 1C) = \$50,951 E. SALVAGE VALUE F. TOTAL INVESTMENT (1D - 1E) = \$50,951 E. SALVAGE VALUE F. TOTAL INVESTMENT (1D - 1E) = \$50,951 E. SALVAGE VALUE F. TOTAL INVESTMENT (1D - 1E) = \$50,951 E. SALVAGE VALUE F. TOTAL INVESTMENT (1D - 1E) = \$50,951 E. COST FUEL TYPE FUEL COST SAMINGS ANNUAL \$DISCOUNT DISCOUNTED SAVINGS (9) COST (-) FUEL TYPE FUEL COST SAVINGS ANNUAL \$DISCOUNT DISCOUNTED SAVINGS (9) SAVINGS (9) A. ELEC SAVAGE (15) (\$100) 1.523 (\$1,529) B. DIST 0 \$50 1.523 (\$1,529) B. DIST 0 \$50 1.523 (\$1,529) C. NAT GAS \$2.21 49 \$108 19.64 \$2.119 D. PAPER 0 \$50 1.522 50 C. NAT GAS \$2.21 49 \$108 19.64 \$2.119 D. PAPER 0 \$50 1.522 50 C. NAT GAS \$2.21 49 \$108 19.64 \$2.119 D. PAPER 0 \$50 1.522 50 C. NAT GAS 3.2.11 49 \$108 19.64 \$2.119 D. PAPER 0 \$50 1.522 50 C. NAT GAS 3.2.11 49 \$108 19.64 \$2.119 D. PAPER 0 \$50 1.522 50 C. NAT GAS 3.2.11 49 \$108 19.64 \$2.119 D. PAPER 0 \$50 1.522 50 C. NAT GAS SAVINGS (4) COST (-) A ANNUAL RECURRING (4-) 1 DISCOUNTE DAVINGS (-) COST (-) A ANNUAL RECURRING (4-) 1 DISCOUNTED SAVINGS (-) COST (-) A ANNUAL RECURRING (4-) 1 DISCOUNTED SAVINGS (-) COST (-) A ANNUAL RECURRING (4-) 1 DISCOUNTED SAVINGS (-) COST (-) SAVINGS (1) COCURRENCE (2) SAVINGS (3) D. SAVINGS (1) COCURRENCE (2) SAVINGS (4) C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (-) COST (-) C. TOTAL NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION A IF 3D1 → 3C THEN GO TO 4 D IF 3D1 → 3C THEN GO TO 4 D IF 3D1 → 3C THEN GO TO 4 D IF 3D1 → 3C THEN GO TO 4 D IF 3D1 → 3C THEN GO TO 4 D IF 3D1 → 3C THEN GO TO 4 D IF 3D1 → 3C THEN GO TO 4 D IF 3D1 → 3C THEN GO TO 4 D IF 3D1 → 3C THEN GO TO 4 D IF 3D1 → 3C THEN GO TO 4 D IF 3D1 → 3C THEN GO TO 4 D IF 3D1 → 3C THEN GO TO 4 D IF 3D1 → 3C THEN GO TO 4 D IF 3D1 → 3C THEN GO TO 4 D IF 3D1 → 3C THEN GO TO 4 D IF 3D1 → 3C THEN GO TO 4 D IF 3D1 → 3C THEN GO TO 4 D IF 3D1 → 3C THEN			ANALYSIS DATE:	06/04/92	`	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
B. SIOH COST (6.5% of 1A) = 3343 C. DESIGN COST (6.0% of 1A) = 3574 C. DESIGN COST (6.0% of 1A) = 3574 C. DESIGN COST (6.0% of 1A) = 35,951 E. SALVAGEVALUE = \$0.00 F. TOTAL INVESTMENT (1D-1E) = \$0.00 F. TOTAL SAMBTU (1) MBTU/TR (2) SAVINGS (3) FACTOR (4) SAVINGS (5) FACTOR (4) SAVINGS (5) F. TOTAL \$0.00 F. T	1	INV	VESTMENT						
C. DESIGN COST (6.0% of 1A) = \$374 D. EMERGY CREDIT (1A + 1B + 1C) = \$50,851 E. SALVAGE VALUE = \$50,851 F. TOTAL INVESTMENT (1D − 1E) = \$50,851 2 ENERGY SAVINGS (+) / COST (-) FUEL TYPE FUEL COST SAVINGS ANNUAL\$ DISCOUNT DISCOUNTED \$40,851 A. ELEC \$6.48 (15) (\$100) 15.23 (\$1,520) B. DIST 0 \$50 17.28 \$50 C. NAT GAS \$2.21 49 \$108 19.44 \$2,119 D. PAPER 0 \$50 17.22 \$50 E. COAL \$50 18.22 \$50 F. TOTAL 33 8.11 — \$509 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) = \$50 B. NON-RECURRING (+/-) (CAST (-) (3A x 3A1) = \$50 B. NON-RECURRING (+/-) (CAST (-) (3A x 3A1) = \$50 D. PAPER \$50 0 0.00 \$50 C. TOTAL NON-ENERGY SAVINGS (+) / COST (-) (3A x 3A1) = \$50 C. TOTAL \$50 0.00 \$50 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = \$50 D. PROJECT NON-ENERGY TEST (25% A33) = \$108 C. TOTAL NON-ENERGY TEST (25% A33) = \$108 A if 301 ⇒ 3 0 THEN GO TO 4 A if FIRST YEAR DOLLAR SAVINGS (+) / COST (-) (2F3 + 3A + (3B1d/25)) = \$50 D. PROJECT NON-ENERGY CALCULATION (2F5 x 0.33) = \$108 A if 301 ⇒ 3 0 THEN GO TO 4 A if FIRST YEAR DOLLAR SAVINGS (+) / COST (-) (2F3 + 3A + (3B1d/25)) = \$50 B. TOTAL NON-ENERGY CALCULATION (2F5 x 0.33) = \$108 A if 301 ⇒ 3 0 THEN GO TO 4 A if FIRST YEAR DOLLAR SAVINGS (+) / COST (-) (2F3 + 3A + (3B1d/25)) = \$50 B. TOTAL NON-ENERGY CALCULATION (2F5 x 0.33) = \$108 A if 301 ⇒ 3 0 THEN GO TO 4 A if FIRST YEAR DOLLAR SAVINGS (+) / COST (-) (2F3 + 3A + (3B1d/25)) = \$50 B. TOTAL NON-ENERGY CALCULATION (2F5 x 0.33) = \$108 B. TOTAL NON-ENERGY CALCULATION (2F5 x 0.33) = \$108 B. TOTAL NON-ENERGY CALCULATION (2F5 x 0.33) = \$108 B. TOTAL NON-ENERGY CALCULATION (2F5 x 0.35) = \$108 B. TOTAL NON-ENERGY CALCULATION (2F5 x 0.35) = \$108 B. TOTAL NON-ENERGY CALCULATION (2F5 x 0.35) = \$108 B. TOTAL NON-ENERGY CALCULATION (2F5 x 0.35) = \$108 B. TOTAL NON-ENERGY CALCULATION (2F5 x 0.35) = \$108 B. TOTAL NON-ENERGY CALCULATION (2F5 x 0.35) = \$108 B. TOTAL NON-ENERGY CALCULATION (2F5 x 0.35) = \$108 B. TOTAL NON-ENERGY CALCULATION (2F5 x 0.35) = \$108 B. TOTAL NON-E		A.	CONSTRUCTION	COST	=		-	\$6,234	
D. ENERGY CREDIT (1A + 1B + 1C) = \$50,851 E. SALVAGE VALUE = \$50 F. TOTAL INVESTMENT (1D − 1E) = \$50,851 E. SALVAGE VALUE = \$50 F. TOTAL INVESTMENT (1D − 1E) = \$50,851 2 ENERGY SAVINGS (+) / COST (−) FUEL TYPE FUEL COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED SAVINGS (+) / COST (−) FUEL TYPE FUEL COST SAVINGS (3) FACTOR (4) SAVINGS (5) A. ELEC \$8.48 (15) (\$100) 15.23 (\$1.520) B. DIST 0 \$50 17.28 \$50 C. NAT GAS \$2.21 49 \$108 19.64 \$21.19 D. PAPER 0 \$50 16.22 \$50 F. TOTAL 33 8.1		В.	SIOH COST		(5.5% of 1A) =			\$343	
E. SALVAGE VALUE F. TOTAL INVESTMENT (1D − 1E) = \$30 \$8,951 2 ENERGY SAVINGS (+) / COST (-) FUEL TYPE FUEL COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED SAVINGS (-) SMBTU (1) MBTU/YR (2) SAVINGS (3) FACTOR (4) SAVINGS (-) A. ELEC \$3.48 (15) (\$100) 15.23 (\$1,520) B. DIST 0 \$50 17.28 \$50 C. NAT GAS \$2.21 49 \$108 19.84 \$2.119 D. PAPER 0 \$50 16.22 \$50 F. TOTAL 33 8.1 \$50 F. TOTAL 33 8.1 \$50 S. NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+) \$50 B. NON-RECURRING (+) \$50 B. NON-RECURRING (+) \$50 C. SAVINGS (1) OCCURRENCE (2) FACTOR(3) SAVINGS (4) B. NON-RECURRING (+) \$50 C. TOTAL \$50 C. TOTAL \$50 C. TOTAL \$50 C. TOTAL NON-ENERGY CALCULATION (2F5 × 30.3) = \$198 a F301 >> 3 CTEN GOTO 4 d F301b >> 1 THEN GO TO 5 (-) (2F3 + 3A + (381d/25)) = \$250 6 DISCOUNTED SAVINGS (+) / COST (-) (2F5 + 3C) = \$250 6 DISCOUNTED SAVINGS (+) / COST (-) (2F5 + 3C) = \$250 6 DISCOUNTED SAVINGS (+) / COST (-) (2F5 + 3C) = \$250 6 DISCOUNTED SAVINGS (-) / COST (-) (2F5 + 3C) = \$250 6 DISCOUNTED SAVINGS (-) / COST (-) (2F5 + 3C) = \$250 6 DISCOUNTED SAVINGS (-) / COST (-) (2F5 + 3C) = \$250 6 DISCOUNTED SAVINGS (-) / COST (-) (2F5 + 3C) = \$250 6 DISCOUNTED SAVINGS (-) / COST (-) (2F5 + 3C) = \$250 6 DISCOUNTED SAVINGS (-) / COST (-) (2F5 + 3C) = \$250 6 DISCOUNTED SAVINGS (-) / COST (-) (2F5 + 3C) = \$250 6 DISCOUNTED SAVINGS (-) / COST (-) (2F5 + 3C) = \$250 6 DISCOUNTED SAVINGS (-) / COST (-) (2F5 + 3C) = \$250 6 DISCOUNTED SAVINGS (-) / COST (-) (2F5 + 3C) = \$250 6 DISCOUNTED SAVINGS (-) / COST (-) (2F5 + 3C) = \$250 6 DISCOUNTED SAVINGS (-) / COST (-) (2F5 + 3C) = \$250 6 DISCOUNTED SAVINGS (-) / COST (-) (2F5 + 3C) = \$250 6 DISCOUNTED SAVINGS (-) / COST (-) (2F5 + 3C) = \$250 6 DISCOUNTED SAVINGS (-) / COST (-) (2F5 + 3C) = \$250		C.	DESIGN COST	•	(6.0% of 1A) =			\$374	
F. TOTAL INVESTMENT (1D - 1E) =		D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$6 ,951	
2 ENERGY SAVINGS (+) / COST (-) FUEL TYPE					-			\$0	
FUEL TYPE		F.	TOTAL INVESTME	NT	(1D – 1E) =			>	\$6,951
### SAVINGS (1) MBTUYR (2) SAVINGS (3) FACTOR (4) SAVINGS (5)	2	EN	IERGY SAVINGS (+)	/ COST (-)					
A. ELEC \$8.48 (15) (\$100) 15.23 (\$1,520) B. DIST 0 \$0 \$0 17.28 \$0 C. NAT GAS \$2.21 49 \$108 19.64 \$2,119 D. PAPER 0 \$0 \$0 16.22 \$0 F. TOTAL 33 8.1			FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
B. DIST 0 \$0 \$10 \$17.28 \$0 C. NATGAS \$2.21 49 \$108 19.64 \$2,119 D. PAPER 0 \$0 \$0 \$0 \$0 E. COAL \$0 \$18.22 \$0 F. TOTAL 33 8.1 \$				\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
C. NAT GAS \$2.21 49 \$108 19.64 \$2,119 D. PAPER 0 \$0 \$0 16.22 \$0 F. TOTAL 33 \$1.1 \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$		A.	ELEC	\$6.48	(15)	(\$100)	15.23	(\$1,520)	•
D. PAPER 0 \$0 \$0 16.22 \$0 E. COAL \$0 16.22 \$0 F. TOTAL 33 8.1 \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$		В.	DIST		0	\$0	17.28	\$0	
E. COAL F. TOTAL 33 8.1 S0 16.22 \$0 F. TOTAL 33 8.1 S0 F. TOTAL 33 8.1 S0 S599 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) 1 DISCOUNT FACTOR (From Table A-2) = 14.88 2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = \$0 SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 D. SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL 50 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 <> 3C THEN GO TO 4 d IF 3D1 b >> 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (FS SC SAVINGS (-) (2F3 + 3A + (3B1d/25)) = \$3 5 TOTAL NET DISCOUNTED SAVINGS (2F5 + SC) = \$599 6 DISCOUNTED SAVINGS (-) (5/1F) = 0.09				\$2.21	49	\$108	19.64	\$2,119	
F. TOTAL 33 8.1 >\$599 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) 1 DISCOUNT FACTOR 2 DISCOUNTED SAVINGS (+) / COST (-) B. NON-RECURRING (+/-) 1TEM SAVINGS (1) CCURRENCE (2) 50 0.00 50 b. 30 0.00 50 c. 4 TOTAL 50 0.00 50 d TOTAL 50 0.00 50 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION a IF 3D1 => 3C THEN GALCULATE SIR c IF 3D1b >> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN GO TO 4 d IF 3D1b d IF 3D1b <> 3 THEN GO TO A d IF 3D1b d IF 3D1b <> 3 THEN GO TO A d IF 3D1b d IF 3D1b d IF 3D1b					0	*-		\$0	
3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) 1 DISCOUNT FACTOR 2 DISCOUNTED SAVINGS (+) / COST (-) B. NON-RECURRING (+/-) ITEM SAVINGS (1) CUCURRENCE (2) FACTOR (3) SAVINGS (4) a. SO 0.00 \$0 b. \$0 0.00 \$0 c. C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 t > 3C THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COST (-) (2F3 + 3A + (3B1d/25)) = \$3 \$5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$35 \$599 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)						*-	16.22	\$0	
A. ANNUAL RECURRING (+/-) = \$0 1 DISCOUNT FACTOR (From Table A-2) = 14.68 2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = \$0 B. NON-RECURRING (+/-) ITEM YEAR OF DISCOUNT DISCOUNTED SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3B44) = \$0 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$198 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN GO TO 4 d IF 3D1b >> 1 THEN GO TO 4 d IF 3D1b <> 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$3599 5 TOTAL NET DISCOUNTED SAVINGS (10) (2F5 + 3C) = \$5599 6 DISCOUNTED SAVINGS—TO—INVESTMENT RATIO (SIR) (5/1F) = 0.099		r.	IOTAL		33	8.1		>	\$599
1 DISCOUNT FACTOR (From Table A-2) = 14.68 2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = \$0 B. NON-RECURRING (+/-) ITEM YEAR OF DISCOUNT DISCOUNTED SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3B44) = \$0 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$198 a IF 3D1 => 3C THEN GO TO 4 d IF 3D1 <> 1 THEN GO TO 4 d IF 3D1 << 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$35 5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$5599 6 DISCOUNTED SAVINGS—TO-INVESTMENT RATIO (SIR) (5/1F) = 0.09	3	NC	N-ENERGY SAVIN	GS (+) / COST	(-)				
2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = \$0 B. NON-RECURRING (+/-) ITEM YEAR OF DISCOUNT DISCOUNTED SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 d TOTAL \$0 \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3B44) = \$0 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$198 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN GO TO 4 d IF 3D1b >= 1 THEN GO TO 4 d IF 3D1b <= 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$8 5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$599 6 DISCOUNTED SAVINGS—TO-INVESTMENT RATIO (SIR) (5/1F) = 0.09		A.	ANNUAL RECURR	ING (+/-)		=		\$0	
B. NON-RECURRING (+/-) ITEM SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$0 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$198 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$8 5 TOTAL NET DISCOUNTED SAVINGS 6 DISCOUNTED SAVINGS (-) / COSTS (-) (5F1) = \$599 6 DISCOUNTED SAVINGS TO-INVESTMENT RATIO (SIR) (5F1F) = 0.09			1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
TIEM			2 DISCOUNTED S	AVINGS (+) / C	COST (-)	(3A x 3A1) =		\$0	
SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$0 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$198 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$3 5 TOTAL NET DISCOUNTED SAVINGS 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.09 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)		В.	NON-RECURRING	i (+/ -)					
a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$0 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$198 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$8 5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$599 6 DISCOUNTED SAVINGS—TO—INVESTMENT RATIO (SIR) (5/1F) = 0.09 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)			ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$0 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$198 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$8 5 TOTAL NET DISCOUNTED SAVINGS (-) COSTS (-) (2F5 + 3C) = \$599 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.09					SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
c. \$0 0.00 \$0 d TOTAL \$0 \$0 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$0 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$198 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b <> 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$8 5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$599 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.09 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)					•			\$0	
d TOTAL \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$0 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$198 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b <> 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$3 5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$599 6 DISCOUNTED SAVINGS—TO—INVESTMENT RATIO (SIR) (5/1F) = 0.09								•	
C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) 5 TOTAL NET DISCOUNTED SAVINGS 6 DISCOUNTED SAVINGS—TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY) 5 TOTAL THEN PROJECT DOES NOT QUALIFY)					•		0.00	-	
D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$198 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$8 5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$599 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.09 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)		c		BGA DISCOLIY	•	T()	(240 + 2Ed4) —	\$0	40
1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$198 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$8 5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$599 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.09 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)					112 <i>D</i> 0AVII103 (+) 7 003	,, (=)	(3A2 + 3B04) =		20
a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F == c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) == \$8 5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) == \$599 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) == 0.09 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)					Y CALCULATION		(2F5 x 0.33) =	\$198	
c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) 5 TOTAL NET DISCOUNTED SAVINGS 6 DISCOUNTED SAVINGS—TO—INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY) 5 OURS IS A NOT A CONTROL OF THE PROJECT DOES NOT QUALIFY)			a IF 3D1 => 3C T	HEN GO TO 4	·		(3. 5 5.55)	V.55	
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$8 5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$599 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.09 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)			b IF 3D1 < 3C TH	IEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =		
4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) 5 TOTAL NET DISCOUNTED SAVINGS 6 DISCOUNTED SAVINGS—TO—INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY) 7 OURS IN PROJECT DOES NOT QUALIFY)			c IF 3D1b => 1 T	HEN GO TO 4					
5 TOTAL NET DISCOUNTED SAVINGS 6 DISCOUNTED SAVINGS—TO—INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY) 7 OURS = RAYD AND AND AND AND AND AND AND AND AND AN			d IF 3D1b < 1 TH	IEN PROJECT	DOES NOT QUALIFY				
5 TOTAL NET DISCOUNTED SAVINGS 6 DISCOUNTED SAVINGS—TO—INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY) 7 OURS = RAYD AND AND AND AND AND AND AND AND AND AN	4	FIF	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$2
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.09 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)						,2. 0	-		
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)									*
7 SIMPLE PAYBACK (SPB) (1F/4) = 857.71							• •		
	7	SIN	MPLE PAYBACK (SP	B)			(1F/4) =		857.71

		LOCATION: White	te Sands Missile i	Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				O-ELECTRIC DHW HE		•	FISCAL YEAR:	1992
		DISCRETE PORTIO		OTAL				
		ANALYSIS DATE:	06/04/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
			23.22					0101211
1	١N١	VESTMENT						
	A.	CONSTRUCTION	COST				\$12,408	
	В.	SIOH COST		(5.5% of 1A) =			\$682	
	C.	DESIGN COST		(6.0% of 1A) =			\$ 744	
	D.	ENERGY CREDIT		(1A+1B+1C)=			\$13,835	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$13,835
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	(35)	(\$225)	15.23	(\$3,420)	
	B.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	80	\$178	19.64	\$ 3,491	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		46	(46.8)		>	\$71
3	NO	N-ENERGY SAVIN	GS (+) / COST (-)			-		
	A.	ANNUAL RECURR	ING (+/-)		=		\$0	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	AVINGS (+) / CO	ST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRING	à (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		с.		\$0		0.00	\$0	
	_	d TOTAL		\$0			\$0	
				ED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$0
	D.	PROJECT NON-EI						
		1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$23	
		a IF 3D1 => 3C T						
		b IF 3D1 < 3C Th		SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T						
		d IF 3D1b < 1 TH	IEN PROJECT DO	DES NOT QUALIFY				
4	FIR	ST YEAR DOLLAR	SAVINGS (+) / CC	OSTS (-)	(2F3 :	+ 3A + (3B1d/25)) =		(\$47)
		TAL NET DISCOUN		• •	(2. 6	(2F5 + 3C) =		\$71
		COUNTED SAVING	•	IENT RATIO (SIR)		(5/1F) =		0.01
		SIR < 1 THEN PRO				(<i>xy</i> =		0.01
7		PLE PAYBACK (SP				(1F/4) =		-29 5.59

		LOCATION: Whit	e Sands Missi	le Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	ECO #10- 1	558-ELECTRIC DHW HE	ATERS		FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/04/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1		VESTMENT						
		CONSTRUCTION	COST	=			\$7,666	
		SIOH COST		(5.5% of 1A) =			\$422	
		DESIGN COST		(6.0% of 1A) =			\$460	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$8,548	
		SALVAGE VALUE					\$0	
	г.	TOTAL INVESTME	.N I	(1D – 1E) =			>	\$8,548
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	(11)	(\$71)	15.23	(\$1,079)	
	В.	DIST		0	\$0	17.28	\$0	
		NAT GAS	\$2.21	26	\$58	19.64	\$1,138	
		PAPER		0	\$0		\$0	
		COAL			\$0	16.22	\$0	
	F.	TOTAL		15	(13.0)		>	\$57
2	NO	M-ENEDGY CAVINI	CC () (COST					
3		N-ENERGY SAVIN ANNUAL RECURR		(-)	_		**	
	7.	1 DISCOUNT FAC			(From Table A-2) =	14.68	\$0	
		2 DISCOUNTED S		COST (=)	(3A x 3A1) =	14.08	\$0	
	В.	NON-RECURRING			(0// 3/1) =		φυ	
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0	.,	0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENER	RGY DISCOU	NTED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$0
	D.	PROJECT NON-E	NERGY TEST					
		1 25% MAXIMUM				(2F5 x 0.33) =	\$19	
		a IF 3D1 => 3C T						
		b IF 3D1 < 3C TH				(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T						
		a ir 3D1b < 1 TH	EN PHOJECT	DOES NOT QUALIFY				
4	FIR	ST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3 ·	+ 3A + (3B1d/25)) =		(\$13)
5	то	TAL NET DISCOUN	TED SAVINGS	3	•	(2F5 + 3C) =		\$57
6	DIS	SCOUNTED SAVING	S-TO-INVES	TMENT RATIO (SIR)		(5/1F) =		0.01
	(IF	SIR < 1 THEN PRO)JECT DOES I	NOT QUALIFY)		•		
7	SIM	MPLE PAYBACK (SP	B)			(1F/4) =		-658.08

		LOCATION: Whit	e Sands Missil	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				321-ELECTRIC DHW HE	ATERS		FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/04/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IN۱	VESTMENT						
	A.	CONSTRUCTION	COST	=			\$2,314	
	В.	SIOH COST		(5.5% of 1A) =			\$127	
	C.	DESIGN COST		(6.0% of 1A) =			\$139	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$2,580	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$2,580
2	FN	IERGY SAVINGS (+)	/COST (-)					
•		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A	ELEC	\$8.48	(394)			(\$38,864)	
		DIST	40.10	0	\$0	17.28	\$0	
		NAT GAS	\$ 2.21	606	\$1,342	19.64	\$26,352	
		PAPER	,	0	\$0	,,,,,	\$0	
		COAL		_	\$0	16.22	\$0	
	F.	TOTAL		212	(1,210.1)		>	(\$12,512)
3		N-ENERGY SAVIN	• •	(–)		•		
	A.	ANNUAL RECURR	• •		=		\$0	
		1 DISCOUNT FAC	-		(From Table A-2) =	14.68		
		2 DISCOUNTED S		OST (-)	(3Å x 3Å1) =		\$0	
	В.	NON-RECURRING	3 (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		C.		\$0		0.00	\$0	
	_	d TOTAL		\$0			\$0	
				ITED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$0
	D.	PROJECT NON-E						
		1 25% MAXIMUM				(2F5 x 0.33) =	(\$4,129)	
		a IF 3D1 => 3C 1						
		b IF 3D1 < 3C TH		TE SIR		(2F5 + 3D1) / 1F =	(\$6)	•
		c IF 3D1b => 1 T						
		d IF 3D1b < 1 Th	IEN PROJECT	DOES NOT QUALIFY				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		(\$1,210)
5	то	TAL NET DISCOUN	TED SAVINGS	,		(2F5 ÷ 3C) =		(\$12,512)
6	DIS	SCOUNTED SAVING	SS-TO-INVES	TMENT RATIO (SIR)		(5/1F) =		-4.85
	(II	F SIR < 1 THEN PRO	DJECT DOES I	OT QUALIFY)				
7	SIA	MPLE PAYBACK (SP	PB)			(1F/4) =		-2.13

		LOCATION: WE	A. O		DEGLOV	_		
		LOCATION: Whi		J	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		DISCRETE PORTI		22-ELECTRIC DHW HE TOTAL	ATERS		FISCAL YEAR:	1992
		ANALYSIS DATE:	06/04/92	TOTAL	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
		ANALISIS DATE.	00/04/92		ECONOMIC LIFE:	25	PHEPARED BT:	A. STOVER
1	IN۱	/ESTMENT						
•		CONSTRUCTION	COST	-			\$12,378	
		SIOH COST		(5.5% of 1A) =			\$681	
		DESIGN COST		(6.0% of 1A) =			\$ 743	
	D.	ENERGY CREDIT		(1A+1B+1C)=			\$13,801	
	E.	SALVAGE VALUE					\$0	
	F.	TOTAL INVESTME	ENT	(1D - 1E) =			>	\$13,801
2	ΕN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	(15)	(\$100)	15.23	(\$1,520)	
	В.	DIST		0	\$0	17.28	\$0	
		NAT GAS	\$2.21	60	\$132	19.64	\$2,589	
		PAPER		0	\$0		\$0	
		COAL			\$0	16.22	\$0	
	F.	TOTAL		44	32.0		>	\$1,069
•	MO	N ENERCY CAVIA	ICC (.) (COCT (•				
3		N-ENERGY SAVIN ANNUAL RECURF		-)	_		••	
	۸.	1 DISCOUNT FAC	, ,		(From Table A-2) =	14.68	\$0	
		2 DISCOUNTED S		OST (~)	(3A x 3A1) =	14.00	\$0	
	В.	NON-RECURRING		. ()	(OAX OAI) =		Ψ	
		ITEM	()		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0		•	\$0	
	C.	TOTAL NON-ENE	RGY DISCOUN	TED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$0
	D.	PROJECT NON-E	NERGY TEST					
		1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$353	
		a IF 3D1 => 3C						
		b IF 3D1 < 3C T		TE SIR		(2F5 + 3D1) / 1F =		-
		c IF 3D1b => 1 7						
		d IF 3D1b < 1 T	HEN PROJECT (DOES NOT QUALIFY				
A	EIE	ST VEAD DOLL AD	SAMINOS (1) (6	COSTS ()	<i>(</i> -=-	. 04 . (05 4 40 7)		
		RST YEAR DOLLAR TAL NET DISCOUN		JUS13 (-)	(2F3	+ 3A + (3B1d/25)) =		\$32
				MENT RATIO (SIR)		(2F5 + 3C) =		\$1,069
Ĭ		SIR < 1 THEN PR				(5/1F) =		0.08
7		MPLE PAYBACK (SF		OT GONEII I)		(1F/4) ≖		400.04
•	J.11	22 5/10/1 (0)	-,			. (17/4) ≖		430.64

		LOCATION. WE	o Oomala Minali	- B	DECION.		DDO ITOT NO.	D.O
		LOCATION: Whit		e Hange 524-ELECTRIC DHW HE	REGION:	4	PROJECT NO: FISCAL YEAR:	DACA 63-91-C-0152 1992
		DISCRETE PORTI			ATERS		FISCAL TEAR:	1992
				TOTAL	ECONOMIC LIEE	05	DDEDARED BY:	A STOVED
		ANALYSIS DATE:	06/04/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IMN	/ESTMENT						
'		CONSTRUCTION	COST	_			\$10,892	
	ъ. В.		0031	(5.5% of 1A) =			\$599	
		DESIGN COST		(6.0% of 1A) =			\$654	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$12,145	
		SALVAGE VALUE		(18+16+10)=			\$0	
		TOTAL INVESTME	:NT	(1D - 1E) =			>	\$ 12,145
	۲.	TOTAL MALSTAL	.141	(10 - 12) =				ψ(2,145
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	(20)		, ,	(\$1,972)	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	59	\$131	19.64	\$2,576	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		39	1.6		>	\$603
3	NO	N-ENERGY SAVIN	GS (+) / COST	(-)				
	A.	ANNUAL RECURP	IING (+/-)		=		\$0	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	AVINGS (+) / C	OST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRING	3 (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENE	RGY DISCOUN	ITED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$0
	D.	PROJECT NON-E	NERGY TEST					
		1 25% MAXIMUM	NON-ENERGY	Y CALCULATION		(2F5 x 0.33) =	\$199	
		a IF 3D1 => 3C 1	THEN GO TO 4					
		b IF 3D1 < 3C Ti	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T	HEN GO TO 4					•
		d IF 3D1b < 1 Th	IEN PROJECT	DOES NOT QUALIFY				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$2
		TAL NET DISCOUN	· ·	• •	,	(2F5 + 3C) =		\$603
				TMENT RATIO (SIR)		(5/1F) =	•	0.05
		F SIR < 1 THEN PRO			•••	, ,		
7		APLE PAYBACK (SP		·		(1F/4) =		7394.50
		,				• •		

		LOCATION: Whit	e Sands Missile	Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	ECO #10-P175	51-ELECTRIC DHW HE	ATERS		FISCAL YEAR:	1992
		DISCRETE PORTIO	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/09/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1		/ESTMENT						
		CONSTRUCTION	COST	=			\$2,324	
		SIOH COST		(5.5% of 1A) =			\$128	
		DESIGN COST		(6.0% of 1A) =			\$139	
		ENERGY CREDIT SALVAGE VALUE		(1A + 1B + 1C) =			\$2,591 \$0	
		TOTAL INVESTME	:NT	(1D – 1E) =			>	\$ 2,591
	••	TO THE INTEGRAL		(10 - 12) -				4 2,381
2	EN	ERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	(2)	(\$13)	15.23	(\$196)	ı
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	23	\$51	19.64	\$1,010	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		21	38.5		>	\$813
2	NO	M ENERGY CAVIN	CC (.) (COCT (`				
3		N-ENERGY SAVIN ANNUAL RECURR	• • • • • • • • • • • • • • • • • • • •	-)	_		*^	
	Α.	1 DISCOUNT FAC	• •		(From Table A-2) =	14.68	\$0	
		2 DISCOUNTED S		OST (-)	(3A x 3A1) =	14.00	\$0	
	В.	NON-RECURRING		,	(2111 2111)		40	
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENE	RGY DISCOUNT	TED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$0
	D.	PROJECT NON-E						
		1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$268	
		a IF 3D1 => 3C 1						
		b IF 3D1 < 3C TI c IF 3D1b => 1 T		ESIR		(2F5 + 3D1) / 1F =		
				DOES NOT QUALIFY				
		4 11 3010 < 1 11	ILIN PROJECT L	DOES NOT QUALIFT				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) / C	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$39
		TAL NET DISCOUN	• •	• ,	(=. 5	(2F5 + 3C) =		\$813
6	DIS	SCOUNTED SAVING	SS-TO-INVEST	MENT RATIO (SIR)	•	(5/1F) =		0.31
		F SIR < 1 THEN PRO				•		
7	SIN	MPLE PAYBACK (SF	PB)			(1F/4) =		67.26

		LOCATION: W	/hite Sands Missi	le Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				753-ELECTRIC DHW HE		•	FISCAL YEAR:	1992
		DISCRETE POP		TOTAL	ATERIO		TIOOAL TEAT.	1002
		ANALYSIS DAT			ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
		AMALIONODAI	L. 03/10/32		LOCITOMIO LII L.	23	FREFARED DT.	A. OTOVEN
1	IN۱	VESTMENT						
		CONSTRUCTIO	N COST	=			\$2,314	
		SIOH COST		(5.5% of 1A) =			\$127	
		DESIGN COST		(6.0% of 1A) =			\$139	
		ENERGY CRED	iT	(1A+1B+1C)=			\$2,580	
		SALVAGE VALU		(/// 12 / 10)=			\$0	
		TOTAL INVEST		(1D – 1E) =			 >	\$2,580
	•			(15 12) =				42,500
2	EN	ERGY SAVINGS	(+) / COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	(3)	(\$17)	15.23	(\$258)	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	12	\$27	19.64	\$535	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		10	10.3		~~~~>	\$277
3	NO	N-ENERGY SAV	/INGS (+) / COST	(-)				
	A.	ANNUAL RECU	RRING (+/-)		=		\$0	
		1 DISCOUNT F	ACTOR		(From Table A-2) =	14.68		
		2 DISCOUNTED	SAVINGS (+) / (COST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURR	ING (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-E	NERGY DISCOU	NTED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$0
	D.	PROJECT NON-	-ENERGY TEST					
		1 25% MAXIMU	IM NON-ENERG	Y CALCULATION		(2F5 x 0.33) =	\$91	
		a IF 3D1 => 3	C THEN GO TO 4	4				
		b IF 3D1 < 3C	THEN CALCULA	ATE SIR		(2F5 + 3D1) / 1F =		
	•	c IF 3D1b =>	1 THEN GO TO 4	ļ				
		d IF 3D1b < 1	THEN PROJECT	DOES NOT QUALIFY				
A	FIE	RST YEAR DOLL	AR SAVINGS (+) /	COSTS (-)	(aEa	+ 3A + (3B1d/25)) =		640
			UNTED SAVINGS		(2°C)	+ 3A + (3610/25)) = (2F5 + 3C) =		\$10 \$277
				TMENT RATIO (SIR)		(2F5 + 3C) = (5/1F) =		\$277 0.11
·			ROJECT DOES I	, ,		(S/1F) =		0.11
7		MPLE PAYBACK (TO I GLONEII I)		/4E/A\ _		054.00
•	JIN	cc	O. 0)			(1F/4) =		251.23

		LOCATION: NO	·					
		LOCATION: Wh		-	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				790-ELECTRIC DHW HE	ATERS		FISCAL YEAR:	1992
		DISCRETE PORT		TOTAL				
		ANALYSIS DATE:	06/09/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
. 1	IN۱	/ESTMENT						
	A.	CONSTRUCTION	COST	=			\$2,334	
	В.	SIOH COST		(5.5% of 1A) =			\$128	
	C.	DESIGN COST		(6.0% of 1A) =			\$140	
	D.	ENERGY CREDIT	•	(1A + 1B + 1C) =			\$2,602	
	E.	SALVAGE VALUE					\$0	
	F.	TOTAL INVESTM	ENT	(1D – 1E) =			> >	\$2,602
2	EN	ERGY SAVINGS (+) / COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	(3)	(\$17)	15.23	(\$258)	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	32	\$70	19.64	\$1,372	
	D.	PAPER	•	0	\$0		\$0	•
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		29	52.9	•	>	\$1,113
_								
3		N-ENERGY SAVIN		(-)				
	A.	ANNUAL RECUR			*		\$0	
		1 DISCOUNT FAC		2007 ()	(From Table A-2) =	14.68		
	R	2 DISCOUNTED :		.OSI (-)	(3A x 3A1) =		\$0	
	.	ITEM	u (++-)		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	DISCOUNTED SAVINGS (4)	
		a.		\$0	COCONNENCE (2)	0.00	• •	
		b.		\$0		0.00	\$0 \$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0	•	0.00	\$0	
	C.		RGY DISCOUN	NTED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =	Ψ0	\$0
		PROJECT NON-E				(6, 2, 654,) -		•
		1 25% MAXIMUM	NON-ENERGY	Y CALCULATION		(2F5 x 0.33) =	\$367	
		a IF 3D1 => 3C	THEN GO TO 4	ļ			•	
		b IF 3D1 < 3C T	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1	THEN GO TO 4	•				
		d IF 3D1b < 1 T	HEN PROJECT	DOES NOT QUALIFY				
4	FIR	IST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(959	+ 3A + (3B1d/25)) =		Ara
		TAL NET DISCOU	_		(EF3	(2F5 + 3C) =		\$53 \$1.12
				TMENT RATIO (SIR)		(2F5 + 3C) = (5/1F) =		\$1,113
-		SIR < 1 THEN PR				(3/1F) =		0.43
7		IPLE PAYBACK (SI		wormin ij		(1F/4) =		40.00
						(174)=		49.22

PROJECT TITLE ECO #10-S1794-ELECTRIC DHW HEATERS FISCAL YEAR: 1992			LOCATION: Whit	te Sands Missile	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
1 INVESTMENT A CONSTRUCTION COST					•	ATERS			1992
INVESTMENT			DISCRETE PORTI	ON NAME:	TOTAL				
A. CONSTRUCTION COST			ANALYSIS DATE:	06/09/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
A. CONSTRUCTION COST									
B. SICH COST (5.5% of 1A) = 3881 C. DESIGN COST (9.0% of 1A) = 3742 C. DESIGN COST (9.0% of 1A) = 3742 C. DESIGN COST (1A+1B+1C) = 3742 C. DESIGN COST (1A+1B+1C) = 300 F. TOTAL INVESTMENT (1D-1E) = 300 F. TOTAL (1D-1E) =	1	IN۱	VESTMENT						
C. DESIGN COST		A.	CONSTRUCTION	COST	=			\$12,374	
D. ENERGY CREDIT (1A+1B+1C) = \$13,797 E. SALVAGE VALUE		В.	SIOH COST		(5.5% of 1A) =			\$681	
E. SALVAGE VALUE F. TOTAL INVESTMENT (1D - 1E) = \$30 F. TOTAL INVESTMENT (1D - 1E) = \$30 F. TOTAL INVESTMENT (1D - 1E) = \$313,797 2 ENERGY SAVINGS (+) / COST (-) FUEL TYPE FUEL COST SAVINGS (BANNUAL SENTE SAVINGS (BANNUAL SE		C.	DESIGN COST		(6.0% of 1A) =			\$742	
E. TOTAL INVESTMENT (1D - 1E) =		D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$13,797	
2 ENERGY SAVINGS (+) / COST (-)		E.	SALVAGE VALUE		=			\$0	
FUEL TYPE		F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$13,797
FUEL TYPE									
### SAVINGS (3) FACTOR (4) SAVINGS (5) A. ELEC	2	EN	IERGY SAVINGS (+)	/ COST (-)					
A. ELEC \$6.48 (5) (\$31) 15.23 (\$471) B. DIST 0 \$0 \$0 17.28 \$0 C. NAT GAS \$2.21 18 \$411 19.64 \$300 D. PAPER 0 \$0 \$0 16.22 \$0 E. COAL \$0 16.22 \$0 F. TOTAL 14 9.8 \$> \$329 S NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-)			FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
B. DIST 0 \$0 \$0 \$17.28 \$0 C. NAT GAS \$2.21 18 \$411 19.84 \$800 D. PAPER 0 \$0 \$0 \$0 \$0 E. COAL \$0 \$16.22 \$0 F. TOTAL 14 \$0.8 \$\$0 \$16.22 \$0 S. NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) = \$0 \$0 1 DISCOUNT FACTOR (From Table A-2) = \$14.68 \$0 B. NON-RECURRING (+/-) (3A \$3A1) = \$0 B. NON-RECURRING (+/-) (3A \$3A1) = \$0 B. NON-RECURRING (+/-) (5A \$0 \$0 \$0 \$0 C. SAVINGS (1) OCCURRENCE (2) FACTOR (3A \$0 \$0 \$0 C. \$0 \$0 \$0 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 *3B44) = \$0 D. PROJECT NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 *3B44) = \$0 D. PROJECT NON-ENERGY CALCULATION (2F5 *0.33) = \$108 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 *3A + (3B1d/25)) = \$10 5 TOTAL NET DISCOUNTED SAVINGS (+) / COSTS (-) (2F5 *3C) = \$329 6 DISCOUNTED SAVINGS (-) (COST) (5F) (5FF) = \$0.02 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)				\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	* *	
C. NAT GAS \$2.21 18 \$411 19.64 \$800 D. PAPER 0 \$0 \$0 16.22 \$0 F. TOTAL 14 9.8 \$0 16.22 \$0 F. TOTAL 14 9.8 \$0 16.22 \$0 SAVINGS (+) / COST (-) \$0 16.22 \$0 SAVINGS (+) / COST (-) \$0 16.22 \$0 SAVINGS (+) / COST (-) \$0 16.22 \$0 3 NON-ENERGY SAVINGS (+) / COST (-) \$0 16.20 \$0 16.22 \$0 1 DISCOUNT FACTOR \$0 16.00 \$0 16.20 \$0 B. NON-RECURRING (+/-) \$0 16.00 \$0 16.20 \$0 B. NON-RECURRING (+/-) \$0 16.00 \$0 16.20 \$0 B. NON-RECURRING (+/-) \$0 16.00 \$0 16.20 \$0 C. \$0 \$0 0.00 \$0 16.20 \$0 C. \$0 0.00 \$0				\$6.48	(5)	(\$31)		(\$471)	1
D. PAPER 0 \$0 \$0 16.22 \$0 F. TOTAL 14 9.8					0	\$0		-	
E. COAL F. TOTAL 14 9.8 30 16.22 \$0 F. TOTAL 14 9.8 30 30 S329 31 SNON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) 1 DISCOUNT FACTOR (From Table A-2) = 14.68 2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = \$0 B. NON-RECURRING (+/-) ITEM YEAR OF DISCOUNT DISCOUNTED SAVINGS (1) CCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 50 b. \$0 0.00 50 c. \$0 0.00 50 c. \$0 0.00 50 c. \$0 0.00 \$				\$2.21	18	\$41	19.64		
F. TOTAL 14 9.8					0	•		,	
3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (4/-) = \$0 1 DISCOUNT FACTOR (From Table A-2) = 14.68 2 DISCOUNTED SAVINGS (6) / COST (-) (3A x 3A1) = \$0 B. NON-RECURRING (4/-) ITEM YEAR OF DISCOUNT DISCOUNTED SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 \$0 0.00 \$0 d TOTAL \$0 \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3B44) = \$0 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$108 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 <> 3C THEN GO TO 4 d IF 3D1b <> 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$10 5 TOTAL NET DISCOUNTED SAVINGS (+) / COSTS (-) (2F5 + 3C) = \$329 6 DISCOUNTED SAVINGS (-) (5/1F) = 0.02							16.22	·	••••
ANNUAL RECURRING (+/-)		F.	TOTAL		14	9.8			\$329
ANNUAL RECURRING (+/-)	•	NO	N-ENEDGY CAVIN	GE (I) LCOST I	(A				
1 DISCOUNT FACTOR	3				(-)	_		•0	
DISCOUNTED SAVINGS (+) / COST (-)		Λ.		• •		(From Table A-2) =	1 <i>A</i> RR	Ψ	
B. NON-RECURRING (+/-)					OST (-)		14.50	\$0	
ITEM		В.			00.()	(577.7 5711) =		40	
SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$0 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$108 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$10 5 TOTAL NET DISCOUNTED SAVINGS 6 DISCOUNTED SAVINGS—TO-INVESTMENT RATIO (SIR) (5/1F) = 0.02 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)				- (/		YEAR OF	DISCOUNT	DISCOUNTED	
a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$0 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$108 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$10 5 TOTAL NET DISCOUNTED SAVINGS 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.02					SAVINGS (1)				
b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$0 D. PROJECT NON-ENERGY CALCULATION (2F5 x 0.33) = \$108 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = c IF 3D1b >> 1 THEN GO TO 4 d IF 3D1b <1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$10 5 TOTAL NET DISCOUNTED SAVINGS 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.02 (IF SIR <1 THEN PROJECT DOES NOT QUALIFY)			a.		• • •	(-,	• •	• •	
c. \$0 0.00 \$0 d TOTAL \$0 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$0 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$108 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 <3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b <1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$10 5 TOTAL NET DISCOUNTED SAVINGS 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.02 (IF SIR <1 THEN PROJECT DOES NOT QUALIFY)			b.		\$0		0.00		
d TOTAL \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$0 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$108 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$10 5 TOTAL NET DISCOUNTED SAVINGS 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.02 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)			c.		\$0		0.00	\$0	
D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$108 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$10 5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$329 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.02 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)			d TOTAL					\$0	
1 25% MAXIMUM NON-ENERGY CALCULATION a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 <> 3C THEN CALCULATE SIR c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) 5 TOTAL NET DISCOUNTED SAVINGS 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY) \$ 108 \$ 108 \$ (2F5 + 3D1) / 1F =		C.	TOTAL NON-ENE	RGY DISCOUN	ITED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$0
a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$10 5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$329 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.02 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)		D.	PROJECT NON-E	NERGY TEST					
b IF 3D1 < 3C THEN CALCULATE SIR c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) 5 TOTAL NET DISCOUNTED SAVINGS 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY) (2F5 + 3D1) / 1F = (2F5 + 3D			1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$108	
c IF 3D1b => 1 THEN GO TO 4 d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) 5 TOTAL NET DISCOUNTED SAVINGS 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY) 5 TOTAL NET DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)			a IF 3D1 => 3C	THEN GO TO 4					
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY 4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$10 5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$329 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.02 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)			b IF 3D1 < 3C T	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =		
4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 ÷ 3A + (3B1d/25)) = \$10 5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$329 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.02 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)			c IF 3D1b => 1 7	HEN GO TO 4			•		
5 TOTAL NET DISCOUNTED SAVINGS 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY) \$329 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)			d IF 3D1b < 1 Ti	HEN PROJECT	DOES NOT QUALIFY				
5 TOTAL NET DISCOUNTED SAVINGS 6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY) \$329 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)	4	FIE	RST YEAR DOLLAR	SAVINGS (±) //	COSTS (-)	(252	+34 + (3R1d/25)) =		\$ 10
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 0.02 (IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)				• •		ى دھ/	, ,,		
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)							-		
	-						(, -		₩ + ₩ tim
	7				,		(1F/4) =		1410.69

CONTRACTOR	эн EMC ENGINEERS INC.			ADDRESS 2750 SO	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	ORTH BLVI	D., #C-200,	DENVER, C	0 80227	
CONTRACT	CONTRACT FOR (Mork to be performed) DOMESTIC HOT WATER HEATERS						PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER		:	PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	DS MISSILE	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	IL COST		LABOR COSTS			
Line	tean (C Lit	Ouantity			Manhours	Average		Other	Line
Š.	€	Measure	6	Unit	Total	Mandays	Rate	Total	Costs	Total
		(2)	(2)	£	2	0)	S	(0)	(e)	(01)
-	BUILDING 102									
	APPURTENANCES	EA	10		LABOR AND MATERIALS 4880					\$4,880.00
	1.5 KW	EA	7	280	1120					\$1,120.00
	2.5 KW	EA	4	300	1200					\$1,200.00
- E	3.0 KW	EA	2	310	029					\$620.00
)4-23	TOTAL									\$7,820.00
2	BUILDING 124									
	APPURTENANCES	EA	21	LABOR AN 488	LABOR AND MATERIALS 488 10248					\$10,248.00
	1.5 KW	EA	15	270	4050					\$4,050.00
	3.0 KW	EA	9	310	1860					\$1,860.00
	TOTAL									\$16,158.00
က	BUILDING 153			-						
	APPURTENANCES	EA	8	LABOR AN 488	LABOR AND MATERIALS 488 1464				·	\$1,464.00
	. 1.0 KW	EA	2	270	540					\$540.00
	3.0 KW	EA	-	310	310					\$310.00
	TOTAL						,			\$2,314.00
	Material Source: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: Means Cost Data, 1992, Rates Include Overhead & Profit	le 25% Overhead	& Profit; Labor Sc	ource: Means Co	it Data, 1992, Rates In	clude Overhead & F	rofit			

CONSTRUCTION COST ESTIMATE BREAKDOWN

_		CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKD	NMC							
					a property						
<u>u</u>	CONTRACTOR	EMC ENGINEERS INC.			2750 SO	2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	ORTH BLV	D., #C-200,	DENVER, C	0 80227	
10	CONTINACT	CONTRACT FOR (WORK to be performed) DOMESTIC HOT WATER HEATERS						PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
ا م	URCHASEF	PURCHASE REQUEST NUMBER	:		PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	IDS MISSILE	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
<u> </u>					MATERIAL COST	√ cost		LABORICOSTS			
•	Line	Item	of Chit	Quantity			Manhours	Average		Other Direct	Line
	No.	(1)	Measure (2)	(3)	Unit (4)	Total (5)	Mandays (6)	Rate (7)	Total (8)	Costs (9)	Total (10)
<u> </u>	4	BUILDING 254									
l		APPURTENANCES	EA	9	LABOR AN 488	LABOR AND MATERIALS 488 2928					\$2,928.00
l		1.0 KW	EA	4	270	1080					\$1,080.00
		3.0 KW	EA	2	310	620					\$620.00
		TOTAL			,						\$4,628.00
D4-2	5	BUILDING 260									
4 _		APPURTENANCES	EA	5	LABOR AN 488	LABOR AND MATERIALS 488 2440					\$2,440.00
		1.0 KW	EA	4	270	1080					\$1,080.00
		3.0 KW	EA	-	310	310					\$310.00
i		TOTAL			·						\$3,830.00
	9	BUILDING 300E									
· ·		APPURTENANCES	EA	6	LABOR AN	LABOR AND MATERIALS 4392					\$4,392.00
		1.0 KW	EA	9	270	1620					\$1,620.00
		3.0 KW	EA	ဗ	310	930					\$930.00
		TOTAL									\$6,942.00

ļ		Ma Source: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead &	de 25% Overhead	& Profit; Labor Sour		ans Cost Data, 1992, Rates Include Overhead & Profit	nclude Overhead &	Profit			

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NM							
CONTRACTOR	TOR EMC ENGINEERS INC.			ADDRESS 2750 SOL	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO	ORTH BLV	D., #C-200.	DENVER. C	0 80227	
CONTRACT	CONTRACT FOR (Work to be performed) DOMESTIC HOT WATER HEATERS						PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	DS MISSILE	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	LCOST		LABOR COSTS			
Line	Item	ور وز	Quantity			Manhours	Average		Other Direct	Line
Ö	(1)	Measure (2)	(3)	Unit	Total (5)	Mandays (6)	Rate (7)	Total (8)	Costs (9)	Total (10)
7	BUILDING 300S									
	APPURTENANCES	E	6	LABOR AN 488	LABOR AND MATERIALS 4392					\$4,392.00
	1.0 KW	EA	9	270	1620					\$1,620.00
	3.0 KW	Æ		310	930					\$930.00
	TOTAL									\$6,942.00
89	BUILDING 300W									:
	APPURTENANCES	EA	6	LABOR AN 488	LABOR AND MATERIALS 4392					\$4,392.00
	1.0 KW	EA	6	270	1620					\$1,620.00
	3.0 KW	E	3	310	930					\$930.00
	TOTAL	·								\$6,942.00
6	BUILDING 380									
	APPURTENANCES	EA	10	LABOR AN 488	LABOR AND MATERIALS 488 4880					\$4,880.00
	1.0 KW	EA	9	270	2430					\$2,430.00
	3.0 KW	Æ	1	310	310					\$310.00
	TOTAL			-						\$7,620.00
	Material Source: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: Means Cost Data, 1992, Rates Include Overhead & Profit	25% Overhead &	Profit; Labor So	urce: Means Cos	t Data, 1992, Rates In	clude Overhead & 1	Profit			

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NWC							
CONTRACTOR				ADDRESS						
	EMC ENGINEERS INC.			2750 SOL	JTH WADSW	ORTH BLV	D., #C-200,	2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO	0 80227	
CONTRACT	CONTRACT FOR (Work to be performed) DOMESTIC HOT WATER HEATERS						PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		-
PURCHASE F	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	NDS MISSILE	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	LCOST		LABOR COSTS			
Line	E <u>01</u>	خ ځ	Organtity			Manhoure	Average		Other	oc.
Š		Measure		Cuit	Total	Mandays	Rate	Total	Costs	Total
		(5)	(0)	Đ	(c)	(o)	S	(9)	(e)	(01)
9	BUILDING 1504									
	APPURTENANCES	EA	5	LABOR AN 488	LABOR AND MATERIALS 488 2440					\$2,440.00
	1.0 KW	EA	4	270	1080		"	·		\$1,080.00
	3.0 KW	EA	1	310	310					\$310.00
	TOTAL									\$3,830.00
Ξ	BUILDING 1506									
	APPURTENANCES	EA	12	LABOR AN 488	LABOR AND MATERIALS 488 5856					\$5,856.00
	1.0 KW	EA	10	270	2700					\$2,700.00
	3.0 KW	Æ	2	310	620					\$620.00
	TOTAL									\$9,176.00
12	BUILDING 1512								,	
	APPURTENANCES	EA	11	LABOR AN	LABOR AND MATERIALS 488 5368					\$5,368.00
	1.0 KW	Æ	8	270	2160					\$2,160.00
	3.0 KW	Ē	ဗ	310	930					\$930.00
	TOTAL									\$8,458.00

cost Data, 1992, Rates Include Overhead & Profit

rce: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source

		CONSTRUCTION COST ESTIMATE BREAKDOWN	: BREAKD(NNO							
1 ~	CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SO	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO	ORTH BLV	D., #C-200,	DENVER, C	O 80227	
, –	CONTRACT F	CONTRACT FOR (WORK to be performed) DOMESTIC HOT WATER HEATERS						PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
	VURCHASER	PURCHASE REQUEST NUMBER			PROJECT NUMBER	ABER		WORK LOCATION WHITE SAN	IDS MISSILE	WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
					MATER	MATERIAL COST		LABOR COSTS			
	Line	Item	Oujt o	Quantity			Manhours	Average		Other Direct	Line
	No.	(1)	Measure (2)	(3)	Unit (4)	Total (5)	Mandays (6)	Rate (7)	Total (8)	Costs (9)	Total (10)
	13	BUILDING 1526									
1		APPURTENANCES	E	8	LABOR AN 488	LABOR AND MATERIALS 488 3904					\$3,904.00
		1.0 KW	EA	2	270	1890					\$1,890.00
		3.0 KW	EA	1	310	310					\$310.00
		TOTAL									\$6,104.00
D4-2	4	BUILDING 1528									
' 27		APPURTENANCES	EA	8	LABOR AN 488	LABOR AND MATERIALS 488 3904				-	\$3,904.00
		1.0 KW	EA	3	270	810					\$810.00
		1.5 KW	EA	1	280	280					\$280.00
		3.0 KW	EA	4	310	1240					\$1,240.00
		TOTAL									\$6,234.00
L	51	BUILDING 1530									
L!		APPURTENANCES	EA	16	LABOR AN 488	LABOR AND MATERIALS 488 7808		·			\$7,808.00
<u>.</u>		1.0 KW	EA	8	270	2160					\$2,160.00
		2.0 KW	EA	8	290	280					\$580.00
<u> </u>		3.0 KW TOTAL	EA	9	310	1860					\$1,860.00
J		Material Source: Sierra Technical Producte, Inc., Denver, CO; Prices Include 25% Overhead &	e 25% Overhead	& Profit; Labor So	ource: Means Co	Profit; Labor Source: Means Cost Data, 1992, Rates Include Overhead & Profit	clude Overhead &	Profit			

	CONSTRUCTION COST ESTIMATE BREAKDOWN	E BREAKD(NWC							
CONTRACTOR	on EMC ENGINEERS INC.			ADDRESS 2750 SOL	JTH WADSW	ORTH BLV	D., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	0 80227	
CONTRACT	CONTRACT FOR (Work to be performed) DOMESTIC HOT WATER HEATERS						PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	NDS MISSILE	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	L COST		LABOR COSTS			
Line	Item	<u>a</u>	Quantity			Manhours	Average		Other Direct	Line
No.	(1)	Measure (2)	ව	Unit (4)	Total (5)	Mandays (6)	Rate	Total (8)	Costs	Total
16	BUILDING 1558									
	APPURTENANCES	EA	7	LABOR AN	LABOR AND MATERIALS 488 3416					\$3,416.00
,	1.0 KW	EA	2	270	540					\$540.00
	3.0 KW	EA	1	310	310					\$310.00
	10.0 KW	EA	4	850	3400					\$3,400.00
	TOTAL									\$7,666.00
17	BUILDING 1621									
	APPURTENANCES	EA	3	LABOR AN	LABOR AND MATERIALS 488 1464					\$1,464.00
	1.0 KW	EA	2	270	540					\$540.00
į	3.0 KW	EA	-	310	310					\$310.00
	TOTAL									\$2,314.00
				(

Cost Data, 1992, Rates Include Overhead & Profit

		CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKD	NMC							
l O	CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SO	UTH WADSW	ORTH BLV	C-200	ADDRESS 2750 SOUTH WADSWORTH BLVD #C-200 DENVER CO 80227	0 80227	
10	XONTRACT F	CONTRACT FOR (Work to be performed) DOMESTIC HOT WATER HEATERS						PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
14	URCHASE R	PURCHASE REQUEST NUMBER			PROJECT NUMBER	ABER		WORK LOCATION WHITE SAN	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
					MATER	MATERIAL COST		LABOR COSTS			
	Line	Item	Onit of	Quantity			Manhours	Average		Other	Line
	No.	(1)	Measure (2)	(3)	G (4)	Total (5)	Mandays (6)	Rate (7)	Total (8)	Costs (9)	Total (10)
	18	BUILDING 1622									
I		APPURTENANCES	EA	16	LABOR AN	LABOR AND MATERIALS 488 7808					\$7,808.00
		1.0 KW	E	6	270	2430					\$2,430.00
		1.5 KW	EA	1	280	280					\$280.00
l l		3.0 KW	EA	9	310	1860					\$1,860.00
4-29	•	TOTAL									\$12,378.00
·	19	BUILDING 1624									
		APPURTENANCES	EA	14	LABOR AN 488	LABOR AND MATERIALS 488 6832					\$6,832.00
		1.0 KW	EA	မ	270	1620					\$1,620.00
		2.0 KW	EA	2	290	580				·	\$580.00
		3.0 KW	EA	9	310	1860					\$1,860.00
		TOTAL									\$10,892.00
L								·			
L											
		Material Source: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: Means Cost Data, 1992, Rates Include Overhead & Profit	25% Overhead	& Profit; Labor Sc	urce: Means Co	st Data, 1992, Rates Ir	clude Overhead & I	rofit			

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	N.N.							
	EMC ENGINEERS INC.			ADDRESS 2750 SOU	TH WADSW	ORTH BLV	D #C-200.	ADDESS 2750 SOUTH WADSWORTH BLVD #C-200, DENVER. CO	O 80227	
	DOMESTIC HOT WATER HEATERS						PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
				PROJECT NUMBER	BEN		WORK LOCATION WHITE SAN	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE. NE	W MEXICO
				MATERIAL COST	Loost		LABOR COSTS			
	Hotel Hotel	ž Č	Quantity			Manhoure	ODEJONY		Other	9
		Measure		Unit	Total	Mandays	Rate	Total	Costs	Total
	(1)	Ø	3	€	(2)	(9)	ε	(8)	6)	(10)
20	BUILDING 1751									
	APPURTENANCES	EA	3	LABOR AN 488	LABOR AND MATERIALS 488 1464					\$1,464.00
	1.0 KW	EA	-	270	270					\$270.00
	1.5 KW	E	-	280	280					\$280.00
	3.0 KW	ā	-	310	310					\$310.00
	TOTAL									\$2,324.00
21	BUILDING 1753			i						
	APPURTENANCES	EA	3	LABOR AN 488	LABOR AND MATERIALS 488 1464					\$1,464.00
	1.0 KW	EA	2	270	540					\$540.00
	3.0 KW	Ā	-	310	310					\$310.00
	TOTAL									\$2,314.00
22	BUILDING 1790									
	APPURTENANCES	EA	3	LABOR AN	LABOR AND MATERIALS 488 1464				·	\$1,464.00
į	1.5 KW	Ą	2	280	560					\$560.00
	3.0 KW	ā	-	310	310					\$310.00
										\$2,334.00
				(,			

se Cost Data, 1992, Rates Include Overhead & Profit urce: Sierra Technical Products, Inc., Denver, CO; Prices include 25% Overhead & Profit; Labor Source

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L		CONCETE IOTION COST ESTIMATE BELAVIOUR		1976.		:					
		CONSTRUCTION COST ESTIMATE	DUEANDO	NA							
		EMC ENGINEERS INC.			ADDRESS 2750 SO	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	ОВТН ВLV	D., #C-200,	DENVER, C	0 80227	
		DOMESTIC HOT WATER HEATERS						PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
					PROJECT NUMBER	IBER		WORK LOCATION WHITE SAN	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
L					MATERIAL COST	L COST		LABORCOSTS			
		ltem	of Crit	Quantity			Manhours	Average		Other Direct	Line
	_	(1)	Measure (2)	ଚ	<u>چ</u> کا	Total (5)	Mandays (6)	Rate (7)	Total (8)	Costs (9)	Total (10)
	23	BUILDING 1794	!								
		APPURTENANCES	. 🖸	3	LABOR AN 488	LABOR AND MATERIALS 488 1464					\$1,464.00
		96 KW	Ā	2	5300	10600					\$10,600.00
		3 KW	EA		310	310					\$310.00
		TOTAL									\$12,374.00
•	24	BUILDING 464									
		APPURTENANCES	Æ	9	LABOR AN 488	LABOR AND MATERIALS 488 2928					\$2,928.00
		1 KW	EA	5	270	1350					\$1,350.00
		3 KW	EA	1	310	310	=				\$310.00
		TOTAL					:				\$4,588.00
		Material Source: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: Means Cost Data, 1992, Pates Include Overhead & Profit	25% Overhead &	Profit; Labor Sor	urce: Means Cos	1 Data, 1992, Rates in	clude Overhead &	Profit			

CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NMC							
EMC ENGINEERS INC.			ADDRESS 2750 SOI	JTH WADSW	ОВТН ВLV	D., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	0 80227	
DOMESTIC HOT WATER HEATERS						PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
			PROJECT NUMBER	EEEE		WORK LOCATION WHITE SAN	ADS MISSILE	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
			MATERIAL COST	L COST		LABOR COSTS			
wo t	ži v	, distriction			Monhouse	Avorage	,	Other	oci I
	Measure	Coalling	Unit	Total	Mandays	Rate	Total	Costs	Total
(1)	(2)	(3)	(4)	(2)	, (9)	6	(8)	(6)	(10)
APPURTENANCES									
1/2" GATE VALVES	EA	3	LABOR AN	LABOR AND MATERIALS 25 75					\$75.00
COPPER PIPE	Я.	10	5	90					\$50.00
WIRING	FT.	75	3.07	230.25					\$230.25
CIRCUIT BREAKER	EA	1	85	65		:			\$65.00
JUNCTION BOX	EA	-	10	10					\$10.00
SWITCH BOX	EA	-	20	20					\$20.00
ELEC. HEATER (LABOR ONLY)	E						38		\$38.00
TOTAL COST W/O HEATER PER INSTALLATION									\$488.25
Material urce: Sierra Technical Products, Inc., Denver, CO; Prices include 25% Overhead & Profit; Labor Sourcey	de 25% Overhead	& Profit; Labor So	ľ	e Cost Data, 1992, Rates Include Overhead & Profit	nclude Overhead &	Profit			



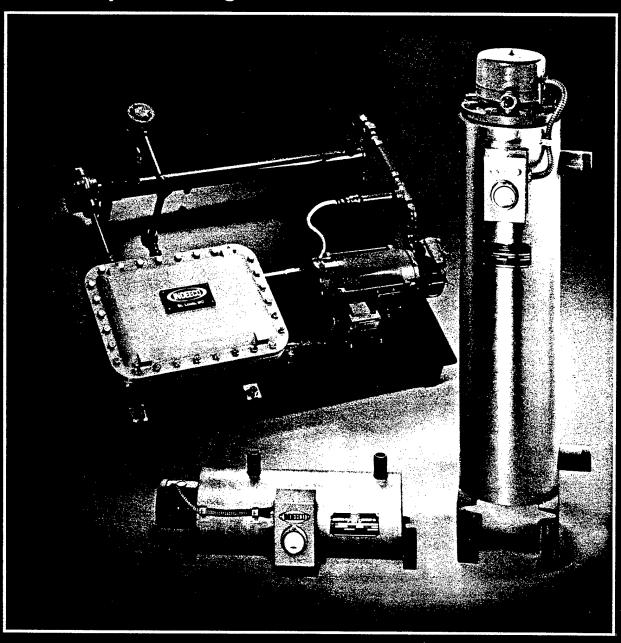


Circulation Heaters

for Liquids and Gases

Featuring New Multi-Purpose Design

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The Series 355 (50 W/In²) INDEECO circulation heaters are designed for heating water. These high quality Water Heaters include the following standard features:

- Copper Sheathed .475" Diameter Heating Elements
- Insulated Steel Vessel with a Galvanized Jacket
- NEMA 1 Terminal Enclosure
- Built-On Thermostat, 60°-250° F. Range
- Choice of Mounting Brackets or Mounting Pads - Six Options Available. See Page 15.
- Flange Heaters have 150 Lb Steel Flanges which meet ANSI B16.5 Standards.
- Rated 160 PSI at 250°F.

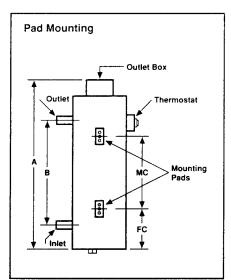
*Indicates factory wired, builton load carrying thermostat. All other built-on thermostats

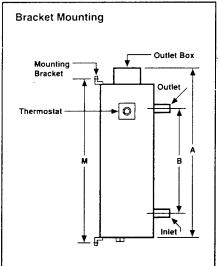
are pilot duty only.

Last two digits of catalog number indicate number of Heater Circuits.

800

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Reference Dimensional Drawings on Page 14.

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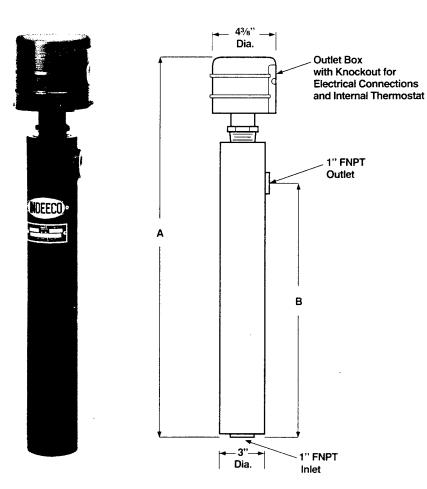
KW	NO. OF ELEMENTS		CATALOG NUMBEI	R		D	IMENSION (INCHES)			WEIGHT (LBS)	
		240V/1 PHASE	240V/3 PHASE	480V/3 PHASE	A	В	MC	FC	M		
		21/2" PIPE TH	READ CONSTR	RUCTION, COP	PER EL	EMENT	S. 50 W	/IN²			
3.0	3	3552N003J01*	3552N003K01*		211/4	93/8	-	-	181/2	30	
4.5	3	3552N005J01*	3552N005K01*	3552N005U01	211/4	93/8		_	181/2	30	
6.0	3	3552N006J01*	3552N006K01*	3552U006U01	343/8	221/2	161/2	55/s	315/8	40	
7.5	3	3552N008J01*	3552N008K01*	3552U008U01	343/8	221/2	161/2	5 ⁵ /8	315/8	41	
9.0	3	3552N009J01*	3552N009K01*	3552U009U01	343/8	221/2	161/2	55/8	315/8	41	
	3	3" - 150 LB. F	LANGE CONST	RUCTION, CO	PPER E	LEMEN	rs. 50 v	V/IN²			
6	3	3553N006J01*	3553N006K01*	3553N006U01	341/4	221/2	161/2	41/8	301/4	65 🗸	
9	3	3553N009J01*	3553N009K01*	3553N009U01	341/4	221/2	161/2	41/8	301/4	66	
12	3	3553N012J03	3553N012K01*	3553N012U01	461/4	341/2	261/2	41/8	421/4	81	
15	3	3553N015J03	3553N015K01	3553N015U01	563/4	45	39	41/8	523/4	91	
18	3	3553N018J03	3553N018K01	3553N018U01	56¾	45	39	41/8	523/4	93	
	5	" - 150 LB. F	LANGE CONST	RUCTION, CO	PPER E	LEMEN	rs. 50 v	V/IN²			
24	6	3554N024J03	3554N024K02	3554N024U01	431/2	30	25	43/4	387/8	135	
30	6		3554N030K02	3554N030U01	501/2	37	25	9	457/8	150	
45	9		3554N045K03	3554N045U03	501/2	37	25	9	457/8	157	
63	9			3554N063U03	62	481/2	25	14	573/8	181	
	8	'' - 150 LB. F	LANGE CONST	RUCTION, CO	PPER E	LEMENT	rs, 50 v	V/IN²		•	
72	18		3555N072K06	3555N072U02	533∕8	341/2	31	83/4	471/2	302	
96	24		3555N096K08	3555N096U04	· 53¾	341/2	31	83/4	471/2	312	
126	18			3555N126U06	661/8	473/8	4313/16	83/4	601/4	361	
144	18			3555N144U06	755/8	56 ⁷ /8	535/16	83/4	693/4	396	
180	18			3555N180U06	86³⁄8	671/2	64	83/4	801/2	443	
240	24			3555N240U08	86³⁄8	671/2	64	83/4	801/2	466	
	1:	2" - 150 LB. F	LANGE CONS	TRUCTION, CO	PPER E	LEMEN	TS, 50 \	N/IN²			
250	42			3557N250U07	64	40	_	_	589/16	748	
300	48			3557N300U08	74	50		-	689/16	819	
350	48			3557N350U16	84	60	_	_	789/16	889	
400	48			3557N400U16	84	60		_	78%/16	906	
450	48			3557N450U16	84	60	_		789/16	924	
500	48 .			3557N500U16	94	70	_	_	889/16	942	
	1	6" - 150 LB. F	LANGE CONS	TRUCTION, CO	PPER E	LEMEN	TS, 50 \	N/IN ²			
500	72			3558N500U24	731/2	48		_	677/8	1110	
600	72			3558N600U24	831/2	58		_	77 ⁷ /8	1210	
700	72			3558N700U24	931/2	68	_		877/8	1284	

3558N800U24

1011/2

STOCK HEATER LISTING

	CATALOG NUMBER	DIMENSION	IS (INCHES)	WEIGHT	
кw	120V/1 PHASE OR 240V/1 PHASE	A	В	(LBS)	
1.5	3591S01.5X01	197/8	123/8	10	
2.0	3591S02.0X01	197/8	123/g	10	
2.5	3591S02.5X01	237/8	163/8	12	
3.0	3591S03.0X01	237/8	16¾s	12	



These compact, lightweight, easy to install heaters can be used for many commercial or light industrial water heating applications. The high quality MINI-BOOSTER Water Heater includes the following standard features:

- 1-1/4" Pipe Thread Immersion Heater with integral load carrying 60° to 180°F thermostat.
- Insulated galvanized steel pipe vessel with painted steel jacket.
- Two .312" diameter copper elements rated at 80 W/In².
- NEMA 1 terminal enclosure
- No mounting brackets required.
- Dual voltage design allows for operation with 120V or 240V power supply.

1 OF 12

HEAT LOSS MUDEL FOR ECO #10: INSTANTANEOUS,
POINT-OF-USE ELECTRIC HW HEATRS.

ENERGY CONSUMPTION OF EXISTING SYSTEM

Summer of Equations:

See following derivations for definitions of symbols.

O Consumed HW: Per ASHRAE, daily hot water unrumption at 140°F is 1.0 gel/person.

work days/year = 5 days/wk x 50 wks/yr = 250.

where m = 8.33 LB x 1.0 gal x N (people) x 250 days

Cp= 1.0 BTU

TR= Temp. ruie = 140-66 = 74

2) Piping heat loss from storage tank to sink

For the cylinder portion of the tank.

Where Do (ft) = outer diameter of insulated tank

Di (ft) = _outer diameter of steel tank

L(ft) = length of tank $V = 0.021 \frac{BTU-Ft}{M-Ft^2}$ $V = 0.021 \frac{BTU-Ft}{M-Ft^2}$ $V = 0.021 \frac{BTU-Ft}{M-Ft^2}$

Ro	0.69	0.73	ררים	0.81	0.84
TRTOR	120	130	140	150	160
Trm	70	70	70	70	70

* (See ATHME 1989 Fundamental, Table J, pg 3.12)

For the ends,

9 (BTY) = LIA (TSTOR-Trm) +8760

1 = \frac{1}{2\lim 1 \tau 1 \ta

LARGETANKS WITH 2" FIBERBLATS INSULATION (HOLIZONTAL)

L = 2Di Do = Di + 0.333 Volume = Aml x L = $\frac{\pi Di^2}{4}$ x 2Di x 7.48 = 11.75Di Di a $\frac{3}{11.75}$

Volume (gal)	200	300	600	750	1000
Di(b)	2.57	2.94	3,49	4.00	4,40
D = (#)	2.90	3,27	3,82	4.33	4.73
L (pt)	5.14	5.88	6.48	8,00	8,80
A and (ft2)	5.19	6.79	9.57	12.57	15.20
Lend (BTU Hr-Fr2.0F)	0.122	0.122	0.122	0.122	0.122
ISTOR (OF)	130	130	130	130	13 6
TROUM (°F)	:70	,70	70	70	70
gend (BT4/42)	.33 XI 06.	" 432 X10	·PIANOP	* EOPMO	.975×106
2/hob.	240,0	0838	0.717	0.63	0.579
In (Do)	5.75	5.07	4.30	3,77	3.44
2TT L (AT) X8760					29,06×10
gar. (BTM)	2.53 KIO"	3,29 NO	45940	6,00×10	7.23 NO"
g 3 (BM)	3.19 x10°	4,16x106	5.82 x10	7.61x106	9.18 XIO
(LARGE) TANKS					

SMALL FANK (VERTICAL) HEAT LOSS Insulation thickness = 1 = 12 FT. $D_0 = D_{\lambda} + \frac{2}{12} = D_{\lambda} + .083$ L ~ 2.75 Di (from several manufacturis cartalogs) Volume (gal) = 7.48 x # Di2 x 2.75Di Area of top = Arop = MDi 9 TOP = LITOP × ATOP × DT X8960 DT = TSTORAG TOP = 1 = 0.267 grop = 0,267 xTT x 8760 Di2 (TETOR -70) = 1837 x D? (TSTOR -70) BTY 9-BOTTOM = 1- BOTTOM X A X DTX8760; 11 BOTTOM = 1-1-109 = 1,09 TDi 28760x (Froe-70) = 7499 D2 (TSTOR -70) BTW/M. 2π L ΔT x 6760 - h (Di) + 2 - h (Di) 7 CYL 1 see table in 151362 D; (AT) BTW/W2; Do = D; + 0.083 47.6 lm (D;) + 2 0.77 x Do AT = TSTOR-70 geron = grow + grown + gaye.

•									}
NOL (KAL)	40	50	60	80	85	97	100	120	
D; (FT)	1.353	1.457	1.548	1.704	1.739	1,817	1.836	1,950	
Do (FT)	1.436	1,546	1,631	1,787	1.822	1.900	1.919	2.033	
D0/D:	1.061	1.057	1,054],044	1,048	1,046	1,045	1,043	
TSTUR (°F)	135	124	136	122	127	130	150	125_	
grop (MBTV)									
PBOTTON (MBTY)	.894	.861_	1.188 //	131 /	Z94 /	1.486	1.519	1.568	,
g cyl (MBT4)	3.57	3.398	4,634 4	1.384 4	.993 5	1709	7.830	5.971	
Prior (MOTY/A	4.686	4.470	6.113 5.	792 6.	604 %	559	1.721	7,923	

Piping LLLAGE HEAT LOSS AFTER BUILDINGS CLOSE

Q

(BTY) = VOLUME (GAL) X P. 33 X 1.08T4 x (Tpipe - Troom) XM

H=# Of COOI down cycles/yr (Normally 250)

Q = VOLUME of System (ullage) in gallows.

Tripe = Tstrage + Tsink

Volume (GAL) = GAL/FT x lingth of pipe

- From MECH ENG HANDBOOK

m. pipe)	GALIFT	
	-0150	and the second s
3	-0/3 4	
3/4	. 0277	
1	.0449	
14	- דרט	
2	. 1743	
21/2	, 2440	

5) HEAT LOSS FROM DAW DIDES WITH CONSTANT CIRCULATION

where i = pipe size index

BTU lose - leat loss rate per foot of pipe of Size i' h-ft i See ASHERE 1991 Applications HB 1, p44.4.

Table 2 Heat Loss of Pipe (at 140°F Inlet, 70°F Ambient Temperatures)

Pipe Size, In.	Bare Copper Tubing, Btu/h/ft	0.5-in. Glass Fiber Insulated Copper Tubing Btu/h · ft
0.75	30	17.7
1	38/	20.3
1.25	46	23.4
1.5	55	25.4
2	66)	29.6
2.5	80	33.8
3	94	× 39.5
4	120	48.4

Take Li from drawings or estimate them.

EXERGY CONSUMPTION. OF INSTANTANEOUS POINT-OF-USE

HEAT LOAD = USAGE = M CP DT = 154, 142 X # OCCUPANTS
BTY/Y

ELEC ENERRY USED = HEAT LOAD = HEAT LOAD

= 154,142×# Occupants (BTU/YR)

Table 1 Dimensionless Numbers Commonly Used in Heat Transfer^a

Name	Symbol	Value .	Application
Nusselt Number	Nu	hD/k or hL/k	Natural or Forced Convection, Boiling or Condensing
Reynolds Number	Re	GD/μ or $\varrho VL/\mu$	Forced Convection
Prandtl Number	Pr	μc _p /k	Natural or Forced Convection, Boiling or Condensing
Stanton Number	St	h/Gc _p	Forced Convection
Grashof Number	Gr	$L^3 \varrho^2 \beta g(\Delta t)/\mu^2$ or $L^3 \varrho^2 g(\Delta t)/T\mu^2$	Natural Convection (for ideal gases)
Fourier Number	Fo	$a au / L^2$	Unsteady State Conduction
Peclet Number	Pe	GDc_p/k or $Re Pr$	Forced Convection (small Pr)
Graetz Number	Gz	GD^2c_n/kL or Re Pt D/L	Laminar Convection

^aA complete list of nomenclature appears at the end of this chapter.

forced convection. If the fluid flow is generated internally by nonhomogeneous densities caused by temperature variation, the heat transfer is termed free or natural convection.

In conduction and convection, heat transfer takes place through matter. For radiant heat transfer, there is a change in energy form; from internal energy at the source to electromagnetic energy for transmission, then back to internal energy at the receiver. Whereas conduction and convection are affected primarily by temperature difference and somewhat by temperature level, the heat transferred by radiation increases rapidly as the temperature increases.

Although some generalized heat transfer equations have been mathematically derived from fundamentals, usually they are obtained from correlations of experimental data. Normally, the correlations employ certain dimensionless numbers from analyses such as dimensional analysis or analogy. Table 1 lists some important dimensionless numbers.

STEADY STATE CONDUCTION

For steady state heat conduction in one dimension, the Fourier equation applies:

$$q = -kA(dt/dx) (1)$$

where

q = heat flow rate, Btu/h

k = thermal conductivity, Btu/h·ft·

A = cross-sectional area normal to flow, ft^2

dt/dx = temperature gradient, °F/fc

Equation (1) states that the heat flow rate q in the x direction is directly proportional to the temperature gradient dt/dx and the cross-sectional area A normal to the flow. The proportionality factor is the thermal conductivity, k. The minus sign indicates that the heat flow is positive in the direction of decreasing temperature. Since conductivity values are sometimes given in other units, consistent units must be used.

Equation (1) may be integrated along a path of constant heat flow rate to obtain:

$$q = k(A_m/L_m)\Delta t = \Delta t/R \tag{2}$$

where

 A_m = mean cross-sectional area normal to flow, ft^2

 L_m = mean length of heat flow path, ft

 Δt = overall temperature difference, °F

 $R = \text{thermal resistance, } ^{\circ}F \cdot h/Btu$

The thermal resistance, R, is directly proportional to the mean length of the heat flow path, L_m , and inversely proportional to the conductivity, k, and the mean cross-sectional area normal to the flow, A_m . Equations for thermal resistances of a few common shapes are given in Table 2. Mathematical solutions to many heat conduction problems are addressed by Carslaw and Jaeger (1959). Complicated problems can be solved by graphical or numerical

methods such as described by Croft and Lilley (1977), Adams and Rogers (1973), and Patankar (1980).

Table 2 Solutions for Some Steady State
Thermal Conduction Problems

System	R in Equation q = Δt/R
Flat wall or curved wall if curvature is small (wall thickness less than 0.1 of inside diameter). Surface area, A	$R = \frac{L}{kA}$
Radial flow through a right circular cylinder.	
Long cyfinder of length, L. r ₁ - r ₂ -	$R = \frac{\ln (r_o/r_i)}{2\pi kL}$
Buried cylinder.	$R = \frac{\ln \left[(a + \sqrt{a^2 - r^2}) / r \right]}{2\pi kL}$ $= \frac{\cosh^{-1} (a/r)}{2\pi kL} (L >> 2r)$
Radial flow in a hollow sphere.	
To the second se	$R = \frac{(1/r_i - 1/r_o)}{4\pi k}$

 $L_a r_a = dimensions, ft$

k = thermal conductivity (at average material temperature, Btu/h·ft·°F

h = heat transfer coefficient, Btu/h ft2. °F

A = surface area, ft2

in Table 9A between 180°F and 280°F, heat loss from a 2-in. pipe is 285.3 Btu/h·ft. Total annual heat loss from the entire line is 285.3 Btu/h·ft \times 165 ft \times 4000 h = 188 million Btu.

In calculating heat flow, Equations (9) and (10) from Chapter 20 generally are used. For dimensions of standard pipe and fitting sizes refer to the Piping Handbook. For insulation product dimensions refer to ASTM Standard C 585, "Recommended Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS) System," or to the insulation manufacturers' literature.

Examples 8 and 9 illustrate how Equations (9) and (10) from Chapter 20 can be used to determine heat loss from both flat and cylindrical surfaces. Figure 6 shows surface resistance as a function of heat transmission for both flat and cylindrical surfaces. The surface emittance is assumed to be 0.85 to 0.90 in still air at 80 °F.

Example 8. Compute heat loss from a boiler wall if the interior insulation surface temperature is 1100°F and ambient still air temperature is 80°F. The wall is insulated with 4.5 in. of mineral fiber block and 0.5 in. of mineral fiber insulating and finishing cement.

Solution: Assume that the mean temperature of the mineral fiber block is 700°F, the mean temperature of the insulating cement is 200°F and the

surface resistance, R_s , is 0.60.

From Table 8, $k_1 = 0.62$ and $k_2 = 0.80$. Using Equation (9) from Chapter 20:

$$q_s = \frac{1100 - 80}{(4.5/0.62) + (0.5/0.80) + 0.60} = \frac{1020}{8.48}$$
$$= 120.2 \text{ Btu/h} \cdot \text{ft}^2$$

As a check, from Figure 6, at 120.2 Btu/h·ft², $R_s = 0.56$. The mean temperature of the mineral fiber block is:

and the mean temperature of the insulating cement is:

$$0.5/0.80 = 0.63$$
; $0.63/2 = 0.31$; $7.26 + 0.31 = 7.57$
 $1100 - [(7.57/8.48)(1020)] = 1100 - 911 = 189$ °F

From Table 8, at 663 °F, $k_1 = 0.60$; at 189 °F, $k_2 = 0.79$. Using these adjusted values to recalculate q_s :

$$q_s = \frac{1020}{(4.5/0.60) + (0.5/0.79) + 0.56} = \frac{1020}{8.69}$$
$$= 117.4 \text{ Btu/h} \cdot \text{ft}^2$$

Table 8 Typical Thermal Conductivity (k) for Industrial Insulations at Various Mean Temperatures - Design Values*

	Accepted	Typical						ip, °	F							
Material	Max. Temp. for Use ^b , °F	Density, lb/ft ³	-100	75	- 50	-25	0	25	50	75	100	200	300	500	700	900
BLANKETS AND FELTS																. :
ALUMINOSILICATE FIBER																
7-10µ diameter fiber	1800	4								0.24		0.32				1.03
	. 2000	6-8			٠.					0.25		0.30				0.95
3µ diameter fiber MINERAL FIBER	2200	4								0.22		0.29	'	0.43	0.35	0.74
(Rock, slag or glass)			•												٠.	
Blanket, metal reinforced	1200	6–12											0.39			
	1000	2.5-6								<i>:</i> .	0.24	0.31	0.40	0.61		
Blanket, flexible, fine-fiber	350	< 0.75						0.28						٠.		
organic bonded		0.75						0.27								:
		1.0						0.25								
·		1.5						0.23								
0		2.0						0.22								
•		3.0				0.19	0.20	0.21	0.22	0.23	0.24	0.31	٠	•	•	
Blanket, flexible, textile-fiber	350	0.65				0.27	0.28	0.29	0.30	0.31	0.32	0.50	0.68			
organic bonded		0.75				0.26	0.27	0.28	0.29	0.31	0.32	0.48	0.66	;		
		1.0				0.24	0.25	0.26	0.27	0.29	0.31	0.45	0.60)		
		1.5				0.22	0.23	0.24	0.25	0.27	0.29	0.39	0.51	-		
		3.0				0.20	0.21	0.22	0.23	0.24	0.25	0.32	0.41			
Felt, semirigid organic bonded	400	3-8						0.24	0.25	0.26	0.27	0.35	0.44			
, , ,	850	3	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.35	0.55			
Laminated and felted without binder	1200	7.5											0.35	0.45	0.60	
BLOCKS, BOARDS, AND PIPE INSULA																*
MAGNESIA	600	11-12											0.42			
85% CALCIUM SILICATE	120 0	11-15									0.38	0.41	0.44			
•	180 0	12-15														0.93
CELLULAR GLASS	90 0	8.5	0.27	0.28	0.29	0.30	0.31	0.32	0.33	0.35	0.36	0.42	.0.49			
DIATOMACEOUS SILICA	160 0	21-22														0.72
	1900	23-25												0.70	0.75	0.80
MINERAL FIBER																
Glass,			_	_	_	_	_					_	_			
Organic bonded, block and boards	400	3-10	0.16	0.17	0.18	0.19	0.20	0.22	0.24	0.25			1			
Nonpunking binder	1000	3-10											0.38	0.52		
Pipe insulation, slag, or glass	350	3-4						0.21								
	500	3-10					0.20	0.22	0.24	0.25	0.26	0.33	0.40			
Inorganic bonded block	1000	10-15									0.33	0.38	0.45	0.55		
-	1800	15-24									0.32	0.37	0.42	0.52	0.62	2 0.74
Pipe insulation, slag, or glass	1000	10-15											0.45			
Resin binder		15	0.23	0.24	0.25	0.26	0.28	0.29	ı							
		••	٠	34		0	٠٠	٠								

Table 8 Typical Thermal Conductivity (k) for Industrial Insulations at Various Mean Temperatures - Design Values (Concluded)

Accepted	Typical	Typical Conductivity k in Btu·ln/h·ft ² ·°F at Mean Ten													
Max. Temp. for Useb, oF	Density, lb/ft ³	- 100	75	- 50	- 25	0	25	50	75	100	200	300	500	700	900
165	1.8-3.5	0.16	0.16	0.17	0.16	0.17	0.18	0.19 0.25	0.20 0.26	0.28					
165	1.25 1.5 1.75	0.17 0.16	0.18	0.19	0.20 0.20 0.19	0.22 0.21 0.20	0.23 0.22 0.22	0.24 0.23 0.23	0.25 0.24 0.24	0.27 0.26 0.25					
	2.0	0.15	0.16	0.18	0.19	0.20	0.21	0.22	0.23	U.24					
210	1.5-2.5	0.16	0.17	0.18	0.18	0.18	0.17	0.16	0.16	0.17					
250	2.0						0.12	0.13	0.14	0.15					
150	3.0 4.5					•	0.11 0.20	0.115 0.21	0.12 0.22	0.125 0.23	; ;				
180	20						0.28	0.30	0.31	0.33			<u></u>		
1800 1200	24-30 30-40									0.49	9 0.5 5 0.8	5 0.6 0 0.8	1 0.7 5 0.9	3 0.8	5
										-		•			
	2.5-3 2-5 3-5 7.6	0.22	2 0.24	0.25 0.13 0.39	0.23 0.14 0.44	7 0.28 4 0.15 0 0.42	0.30 0.15 2 0.44	0.26 0.31 0.16 0.45	0.28 0.33 0.17 0.47	0.31 0.35 0.18 0.49	5 3 9.				-
	Max. Temp. for Use ^b , °F 165 165 210 250 150 180	Max. Temp. for Useb, °F Density, lb/ft3 165 1.8-3.5 165 1 1.25 1.75 2.0 210 1.5-2.5 250 2.0 3.0 150 4.5 180 20 1800 24-30 1200 30-40	Max. Temp. for Useb, °F Density, lb/ft ³ -100 165 1.8-3.5 0.16 165 1 0.17 1.25 0.17 1.5 0.16 1.75 0.16 2.0 0.15 210 1.5-2.5 0.16 250 2.0 3.0 150 4.5 180 20 1800 24-30 1200 30-40	Max. Temp. for Useb, °F Density, lb/ft³ -100 -75 165 1.8-3.5 0.16 0.16 1.65 1 0.17 0.19 1.25 0.17 0.18 1.5 0.16 0.17 2.0 0.15 0.16 210 1.5-2.5 0.16 0.17 2.0 3.0 1.50 4.5 180 20 1800 24-30 1200 30-40 2.5-3 2-5 3-5 0.22 0.24 7.6	Max. Temp. for Use ^b , °F lb/ft ³ -100 -75 -50 165 1.8-3.5 0.16 0.16 0.17 0.19 0.20 1.25 0.17 0.18 0.19 1.5 0.16 0.17 0.18 1.75 0.16 0.17 0.18 2.0 0.15 0.16 0.17 0.18 2.0 1.5-2.5 0.16 0.17 0.18 250 2.0 3.0 150 4.5 180 20 2.5-3 2-5 3-5 0.22 0.24 0.25 7.6 7.8 2	Max. Temp. for Use ^b , °F Density, lb/ft ³ -100 -75 -50 -25 165 1.8-3.5 0.16 0.16 0.17 0.16 1.25 0.17 0.18 0.19 0.20 1.5 0.16 0.17 0.18 0.19 0.20 1.75 0.16 0.17 0.18 0.19 2.0 0.15 0.16 0.18 0.19 210 1.5-2.5 0.16 0.17 0.18 0.18 250 2.0 3.0 150 4.5 180 20 2.5-3 2-5 0.22 0.24 0.25 0.27 7.6 7.8 2 0.39 0.44	Max. Temp. for Use ^b , °F Density, lb/ft ³ -100 -75 -50 -25 0 165 1.8-3.5 0.16 0.16 0.17 0.16 0.17 0.16 0.17 0.19 0.20 0.21 0.22 1.25 0.17 0.18 0.19 0.20 0.21 1.75 0.16 0.17 0.18 0.19 0.20 0.21 1.75 0.16 0.17 0.18 0.19 0.20 0.21 2.0 0.15 0.16 0.18 0.19 0.20 0.20 0.15 0.16 0.18 0.19 0.20 0.20 0.15 0.16 0.18 0.19 0.20 0.20 0.15 0.16 0.17 0.18 0.18 0.18 0.18 0.19 0.20 0.20 0.20 0.20 0.20 0.20 0.20 0.2	Max. Temp. for Use ^b , °F lb/ft ³	Max. Temp. for Use ^b , °F lb/ft ³	Max. Temp. for Use ^b , °F Density, lb/ft ³ -100 -75 -50 -25 0 25 50 75 165 1 0.17 0.19 0.20 0.21 0.22 0.24 0.25 0.26 1.25 0.17 0.18 0.19 0.20 0.21 0.22 0.23 0.24 0.25 1.5 0.16 0.17 0.19 0.20 0.21 0.22 0.23 0.24 0.25 1.75 0.16 0.17 0.18 0.19 0.20 0.21 0.22 0.23 0.24 2.0 0.15 0.16 0.18 0.19 0.20 0.21 0.22 0.23 0.24 2.0 0.15 0.16 0.18 0.19 0.20 0.21 0.22 0.23 210 1.5-2.5 0.16 0.17 0.18 0.18 0.18 0.17 0.16 0.16 250 2.0 0.12 0.13 0.14 150 4.5 0.20 0.21 0.22 180 20 0.28 0.30 0.31 1800 24-30 1200 30-40 2.5-3 0.19 0.21 0.23 0.25 0.26 0.27 0.28 0.30 0.31 0.10 0.12 0.13 0.14 0.10 0.15 0.16 0.17 0.18 0.19 0.20 0.21 0.22 0.28 0.30 0.31 0.10 0.11 0.115 0.12 0.29 0.21 0.22 0.29 0.29 0.29 0.29 0.29 0.29 0.29 0.29	Max. Temp. for Use ^b , °F lb/ft ³	Max. Temp. for Use ^b , °F Density, lb/ft ³	Max. Temp. for Use ^b , °F Density, lb/ft ³	Max. Temp. for Useb, °F Density, for Useb,	Max. Temp. for Use ^b , °F Density, lb/ft ³

*Representative values for dry materials, which are intended as design (not specification) values for materials in normal use. Insulation materials in actual service may have thermal values that vary from design values depending on their in-situ properties (e.g., density and moisture content). For properties of a particular product, use the value supplied by the manufacturer or by unbiased tests.

*These temperatures are generally accepted as maximum. When operating temperature approaches these limits follow the manufacturer's recommendations.

From Figure 6, at 117.4 Btu/h·ft², $R_s = 0.56$. The mean temperature of the mineral fiber block is:

$$4.5/0.6 = 7.50$$
; $7.50/2 = 3.75$
 $1100 - [(3.75/8.69)(1020)] = 1100 - 440 = 660$ °F

and the mean temperature of the insulating cement is:

$$0.5/0.79 = 0.63$$
; $0.63/2 = 0.31$; $7.50 + 0.31 = 7.81$
 $1100 - [(7.81/8.69)(1020)] = 1100 - 917 = 183$ °F

From Table 8, at 660°F, $k_1 = 0.60$; at 183°F, $k_2 = 0.79$. Since R_s , k_1 and k_2 do not change at these values, $q_s = 117.4$ Btu/h·ft².

Example 9. Compute heat loss per square foot of outer surface of insulation if pipe temperature is 1200°F and ambient still air temperature is 80°F. The pipe is nominal 6-in. steel pipe, insulated with a nominal 3-in. thick diatomaceous silica as the inner layer and a nominal 2-in. thick calcium silicate as the outer layer.

Solution: From Chapter 33 of the 1988 EQUIPMENT Volume, $r_o = 3.31$ in. A nominal 3-in. thick diatomaceous silica insulation to fit a nominal 6-in. steel pipe is 3.02 in. thick. A nominal 2-in. thick calcium silicate insulation to fit over the 3.02-in. diatomaceous silica is 2.08 in. thick. Therefore, $r_i = 6.33$ in. and $r_s = 8.41$ in.

Assume that the mean temperature of the diatomaceous silica is 600 °F, the mean temperature of the calcium silicate is 250 °F and the surface resistance, R_s is 0.50. From Table 8, $k_1 = 0.66$; $k_2 = 0.42$. By Equation (10) from Chapter 20:

$$q_s = \frac{1200 - 80}{[8.41 \ln (6.33/3.31)/0.66] + [8.41 \ln (8.41/6.33)/0.40] + 0.50}$$
$$= \frac{1120}{(5.45/0.66) + (2.39/0.40) + 0.50} = 76.0 \text{ Btu/h} \cdot \text{ft}^2$$

^cSome polyurethane foams are formed by means that produce a stable product (with respect to k), but most are blown with refrigerant and will change with time.

dSee Table 4, footnote h. eSee Table 4, footnote i.

From Figure 6, at 76.0 Btu/h \cdot ft², $R_s = 0.60$. The mean temperature of the diatomaceous silica is:

5.45/0.66 = 8.26; 8.26/2 = 4.13 1200 - [(4.13/14.83) (1120)] = 1200 - 312 = 888 F and the mean temperature of the calcium silicate is: 2.39/0.40 = 5.98; 5.98/2 = 2.99; 8.26 + 2.99 = 11.251200 - [(11.25/14.83)(1120)] = 1200 - 850 = 350 F

From Table 8, $k_1 = 0.72$; $k_2 = 0.46$. Recalculating:

$$q_s = \frac{1120}{(5.45/0.72) + (2.39/0.46) + 0.60} = 83.8 \text{ Btu/h} \cdot \text{ft}^2$$

From Figure 6 at 83.8 Btu/h·ft², $R_s = 0.59$. The mean temperature of the diatomaceous silica is:

and the mean temperature of the calcium silicate is: 2.39/0.46 = 5.20; 5.20/2 = 2.60; 7.57 + 2.60 = 10.17 1200 - [(10.17/13.36)(1120)] = 1200 - 853 = 347°F From Table 8, $k_1 = 0.72$; $k_2 = 0.46$. Recalculating:

$$q_s = \frac{1120}{(5.45/0.72) + (2.39/0.46) + 0.59} = 83.8 \text{ Btu/h} \cdot \text{ft}^2$$

Since R_s , k_1 , and k_2 do not change at 83.8 Btu/h·ft², this is q_s . The heat flow per ft² of the inner surface of the insulation is: $q_o = q_s(r_s/r_o) = 83.8(8.41/3.31) = 213 \text{ Btu/h·ft}^2$ laboratory test conditions. Air gaps in these types of insulation systems can seriously degrade thermal performance as a result of air movement due to both natural and forced convection. Sabine et al. (1975) found the tabular values are not necessarily additive for multiple-layer, low-emittance airspaces, and tests on actual constructions should be conducted to accurately determine thermal resistance values.

Values for foil insulation products supplied by manufacturers must also be used with caution because they apply only to systems that are identical to the configuration in which the product was tested. In addition, surface oxidation, dust accumulation, and other factors that change the condition of the low-emittance surface can reduce the thermal effectiveness of these insulation systems. Deterioration results from contact with several types of solutions, either acidic or basic (e.g., wet cement mortar or the preservatives found in decay-resistant lumber). Polluted environments may cause rapid and severe material degradation. However, site inspections show a predominance of well-preserved installations and only a small number of cases in which rapid and severe deterioration has occurred.

CALCULATING OVERALL THERMAL RESISTANCES

Relatively small conductive elements within an insulating layer or thermal bridges can substantially reduce the average thermal resistance of a component. Examples include wood and metal studs in frame walls, concrete webs in concrete masonry walls, and metal ties or other elements in insulated wall panels. The following examples illustrate how to calculate R-values and U-factors for components containing thermal bridges.

The following conditions are assumed in calculating the design R-values:

(1) Equilibrium or steady-state heat transfer, disregarding effects of heat storage;

- (2) Surrounding surfaces at ambient air temperature;
- (3) Exterior wind velocity of 15 mph for winter (surface with R = 0.17 °F · ft² · h/Btu) and 7.5 mph for summer (surface with R = 0.25 °F · ft² · h/Btu); and
- (4) Surface emittance of ordinary building materials is 0.90.

Table 1 Surface Conductances, Btu/h·ft².oF, and Resistances, oF·ft²·h/Btu, for Air^{a,b,c,d}

			Surfa	ittano	e, e			
Position of	Direction	No	n-V	Reflective				
Surface	of Heat	refle	(reflective)					
	Flow	€ =	0.90	ε =	0.20	€ =	0.05	
		h_{i}	R	h _i	R	h_l	R	
STILL ALR								
Horizontal	Upward	1.63	0.61	0.91	1.10	0.76	1.32	
Sloping—45°	Upward	1.60	0.62	0.88	1.14	0.73	1.37	
Vertical	Horizontal	1.46	0.68	0.74	1.35	0.59	1.70	
Sloping—45°	Downward	1.32	0.76	0.60	1.67	0.45	2.22	
Horizontal	Downward	1.08	0.92	0.37	2.70	0.22	4.55	
MOVING AIR (A	ny Position)	h ₀	R	h ₀	R	h ₀	R	
15-mph Wind (for winter)	Any	6.00	0.17	-	_	-	- 3	
7.5-mph Wind (for summer)	Any	4.00	0.25	-	-	-	_ ·	

aNo surface has both an airspace resistance value and a surface resistance value. No airspace value exists for any surface facing an airspace of less than 0.5 is. bFor ventilated attics or spaces above ceilings under summer conditions (heat flow down), see Table 5.

Conductances are for surfaces of the stated emittance facing virtual blackbody surroundings at the same temperature as the ambient air. Values are based on a surface-air temperature difference of 10°F and for surface temperature of 70°F.

dSee Chapter 3 for more detailed information, especially Tables 5 and 6, and see Figure 1 for additional data.

**Condensate can have a significant impact on surface emittance (see Table 3).

Table 2 Thermal Resistances of Plane Airspaces abe, oF · ft2 · h/Btu

Position	Direction	Airsp.	ясе /		.: 0.5-	in. Airsı	pacee	· . · · ;		0.	75-in. Airspa	ice ^c	ान है।
of Airspace	of Heat	Mean Temp.d	Temp. Diff.d,	•	Effectiv	ve Emitta	nce Eda			Effec	tive Emittane	e Fde	i Cora
p	Flow		্ৰ	0.03	0.05	0.2	0.5	0.82	0.03	0.05	0.2	0.5	0.82
	Nage for the	1047ft 90 ft 6m	·. 10 · ·	2.13	2.03	., 1.51	0.99	0.73	2.34	2.22	1.61	1.04	0.75
		S of	30	1.62	1.57	1.29	0.96	0.75	1.71	1.66	1.35	0.99	0.77
	1	50	10	2.13	2.05	1.60	. 1.11	0.84	2.30	2.21	1.70	1.16	0.87. 0.93
Horiz.	Up	0	20 10	1.73 2.10	1.70 2.04	1.45	1.12 1.27	0.91 1.00	1.83 2.23	1.79 2.16	1.52 1.78	1.1 6 1.21	1.02
		-40	. 20 ·	1.69	1.66	1.49	1.23	1.04	1.77	1.74	1.55	1.27	1.07
	ା ବ୍ୟବସ୍ଥ ବ	-50	10	2.04	2.00	1.75	1.40	1.16	2.16	2.11	1.84	1.46	1.20
	35 C. C. C. C.	1.0			1. The 184	į.							1.4
, .	100 40 100	90	10	2.44	2.31	1.65	1.06	0.76	2.96	2.78	1.88	1.15	0.81
		√ 50	30	2.06	1.98	1.56	1.10	0.83	1.99	1.92	1.52	1.08	0.82 0.94
45*	11	₹ 50	10 20	2.55 2.20	2.44	1.83 1.76	1.22 1.30	0.90 1.02	2.90 2.13	2.75 2.07	2.00 1.72	1.29 1.28	1.00
Slope	Up /	, ,	10	2.63	2.54	2.03	1.30	1.10	2.72	2.62	2.08	1.47	1.12
		-50	20	2.08	2.04	1.78	1.42	1.17	2.05	2.01	1.76	1.41	1.16
	36 S. S. S. S. F.	-50	- 10 -	2.62	2.56	2.17	1.66	1.33	2.53	2.47	2.10	1.62	1.30
		90	10	2.47	2.34	1.67	1.06	0.77	3.50	3.24	2.08	1.22	0.84
		50	30	2.57	2.46	1.84	1.23	0.90	2.91	2.77	2.01	1.30	0.94
	,	50	10	2.66	2.54	1.88	1.24	0.91	3.70	3.46	2.35	1.43	1.01
Vertical	Horiz. —	 0	20	2.82	2.72	2.14	1.50	1.13	3.14	3.02	2.32	1.58	1.18 1.26
		0	10	2.93	2.82	2.20	1.53	1.15	3.77	3.59	2.64	1.73	1.39
		50 50	- 20 10	2.90 3.20	2.82 3.10	2.35 2.54	1.76 1.87	1.39 1.46	2.90 3.72	2.83 3.60	2.36 2.87	1.77 2.04	1.56
		90	10	2.48	2.34	1.67	1.06	0.77	3.53	3.27	2.10	1.22	0.8 4 0.9 9
45*		50	30	2.64	2.52	1.87	1.24	0.91	3.43	3.23	2.24	1.39	1.02
Slope	Down	50	10 20	2.67 2.91	2.55 2.80	1.89 2.19	1.25 1.52	0.9 2 1.15	3.81 3.75	3.57 3.57	2.40 2.63	1.45 1.72	1.26
Stope	Down 1	\. ŏ	10	2.94	2.83	2.21	1.53	1.15	4.12	3.91	2.81	1.80	1.30
		-50	20	3.16	3.07	2.52	1.86	1.45	3.78	3.65	2.90	2.05	1.57 1.6 6
	÷	-50	10	3.26	3.16	2.58	1.89	1.47	4.35	4.18	3.22	2.21	1.66
		90	10	2.48	2.34	1.67	1.06	0.77	3.55	3.29	2.10	1.22	0.85
		50	30	2.66	2.54	1.88	1.24	0.91	3.77	3.52	2.38	1.44	1.0 2 1.0 3
	_	50	10	2.67	2.55	1.89	1.25	0.92	3.84	3.59	2.41	1.45	1.02
Horiz.	Down	0	20	2.94	2.83	2.20	1.53	1.15	4.18	3.96	2.83	1.81	1.31
	•	-50	10 20	2.96	2.85 3.15	2.22 2.58	1.53 1.89	1.16 1.47	4.25 4.60	4.02	2.87	1.82 2.28	1.69
	1	-50 -50	10	3.25 3.28	3.13	2.60	1.90	1.47	4.00	4.41 4.51	3.36 3.42	2.28	1.71

104-47

ECO生10; INSTALL INSTANTANEOUS ELECTRIC HOT WATER HEADUS EXAMPLE CALCULATIONS

BUILDING 153:

Data:

occupants 18

restrooms 5

sinks I per restroom

showers O

Water temperature at the sinks 120°F

Storage tank water temperature 140°F

cold nater supply temperature 66°F

Circulation pump — none

source — 40 gal. dhw heater, gas-fired.

Existing System Calculations

MER Rm temp = 70°F

Di= storage tank diameter Without insulation = 1.35 Fx.

Do= " " with " = 1.43 Fx.

L = Tank height:

-= 3.72FX

K = 0.021 (BTu-Ft)/hr-Ft2-4 (Fibergless) ho = an film heat transfer coefficient = 0.77 (BTU/h-4F)

$$g_3 = 6760 \times 10^{-6} \times \left[\frac{2.34}{0.021} + \frac{211 \times 3.72}{0.021} + \frac{2}{0.77 \times 1.43} \right] \times 70$$

Total existing system some energy = 8.36 MRTY = 12.86 MBTU.

Total existing annual gas cost = 12.86 mBT x # 3.423/mBT4 = # 44.02

modified system:

Soma energy = 2,77 MBTU/yr = 2,77 MBTU/yr

Annual energy cost = 2,77 x # 18.37/mBTu = 50.88

ANNUAL ECO energy cost savings = \$44.02 - \$50.88 = (\$6.86)

CONCLUSION: THE ECO IS NOT ECONOMICALLY VIABLE. THERE
IS A NEGATIVE ANNUAL ENERGY GOST WHICH CANNOT
A MUNTILE THE CUST OF INSTALLATION.

BECAUSE THE COST PER MOTH FUR ELECTRICITY IS 5,37 TIMES AS MUCH AS FOR NATURAL GAS, AND BECAUSE THE ELECTRIC UNIT AFRE IS 1,538 TIMES AS HIGH AS THE GAS UNITS, THE HOT WATER USAGE COST IS 3,49 TIMES MORE EXPENSIVE FOR THE ELECTRIC UNITT. THIS LARGE DIFFERENTIAL IS NOT MADE UP BY THE STORAGE AND PIPING HEAT LUSSES OF THE GAS-FIRED IS HISTEMS, WHICH AMOUNT TO ABOUT 3 TIMES THE USAGE.

EXAMPLE CALCULATION:

BLDG 254

47 Occupants

Source = gas-find 4 ugal dhw heath. AFUE = 0.65 Taink = 139°F

TETER = 140°F piping longth is regligible.

Existing Energy ULL:

9, = 2083 ×47 × (140-66) = 7.24 MBT4/yr.

22= 2083 x 47 x (140-139) = 0.098 MBTU/y.

73 = same as BLOG 153 = 458 MBTU/yr.

g += ngligible = 0

TOTAL WAS = 11492 MBTU/yr

Source ENERGY = 11,92 = 18,33 MBTU/yr

Annual energy wet = 18,33 MBTUX # 3.423/MBTU = 62,75

Proposal System:

g = g = 7,24 MBT4/yr.

Source = range = = = 7.24 MBM/yr.

Annual many wate 7.24 X # K.37/MBTM = # 138.00

ANNUAL WAT SAVINGS = # 62.75 - # 133.00 - (# 70,25)

CONCLUSION: THE ECO IN NOT FEMERALE ECONOMICALLY.

BLOG 236 (GYMNASIUM):	5 OF 14
EXISTING SERVICE HOTWATER SYSTEM DATA!	
STORAGE CAPACITY: 1375 GAL. @ 160° Z" calcium silicate	in winter; 150° in summ
Heatsource: Steam boiler via heat a	monter in winter.
Revie pump: 1/2 HP runs continuousle	
Schaule of use: 75 shovers/day, 7 c	Jays/wk@ 12 gal/down, 7 days/wk@ 0.5 gal/use
shows: 15 in mens lucher room. 5 in women's "	
La voatories: 5, in men's lucker room 2 in women's locker roos	m .
Supply + return piping; 75 FT 2" ensul 200 FT 1 2" 1	ected pipe
ESTIMATED AFLE! BOILER/HT EXCH 406AL DHW HEAT	

HW AEHT LOADS!		
1. USAGE?	1 <u></u>	

- showns 75/d x 12 gal x 350 d/yr = 315,000 gal/yr.

lavoratries 100/d x 0.5 gal x 350 d/yr = 17,500 gal/yr.

FOTAL!

332,500 gal/yr.

USARELOAD = q (MBT4) = 8.33 x 332,500 x (155-66) x106 = 246.5 MBT4/yn.

2. STORAGE LOSS

-volume (CF) = Cricular area x length = AXL L= 2xdiameter (Di) A= 17Di²

Volume, 5-gal = 7,44x TDix ZDi = 11.75 Di3

D:= \$\frac{1375}{11.75} - = \$\frac{117.0}{11.75} = 4.9. ft.

Do = 49+ 4/2 = 5.22 ft.

L= 2D1 = 9.8 FT.

Tank ends loss: g= UA (TSTOR-Trm) x8760

Rins + PAIR 3.14 +0.68

A = 2 x TD2 = T1(5,22) = 85168F

Trm=70°F

9 Lands = 0.262×85.6×(160-70)×8760×10-6

CLYNDRICAL SIDES LUSS: 2 (MBTH) = 3TT L x F7G0 X 10 x (90) 2π (9,8) x 8760 x 40 x 10-6 .021 ln (5.22) + 2 0.84×6.22 $\frac{48.5}{01} = 14.01 \text{ MRTU/yr}.$ TOTAL STORAGE LOSS = 17,68+ 14,01 = 31.69 MBT4/42 3. Piping Loss: (ASHLAF 1991 A 44.4, Table 2) 75 FA 07 2" ins pipe @ 29.6 BTUH x 8760h = 19.45 MBTU 200 Ft of 1/2" ins. pipe @ 25.4 BT4H x 876 UM = 44,50 MBTU 200 Ft OF 1" in pipe @ 2013 BTUH 1876 0 In = 35.56 MBTU = 99,51 MBTY TOTAL PIPING LUSS TOTAL SYSTEM WAD = 246.5 + 31.69 + 99.51 = 377.7 MRTM SUMMER LOAD (MAY THRUSEP) = 5 x 377.7 = 157.38 MBTY WINTER LUAD (OCT THRM APRIL) = 7 X377.7= 220,32 MBTY

EXISTING SYSTEM BOURCE ENERGY!	
N. GAS! SUMMER: 157.38 = 224.8	
WATER! 220.32 = 367.2	
0.60	
TOTAC = 592.0 MBTU	
ELEC: 12 HPX0.746 KW X876 Ohe= 545 KW.	
x .0034/3 MBT4	
= 1.86-MBTU elec /yr.	
Annual Source Energy Cost:	
N.GAS: 592.0 MBTU X # 3,423/MBTU=\$ 2026.51	
Elec: 1.86 MBTU X #18.37 /MBTY = \$ 34.17	
TOTAL ANNUAL ENERGY CUST (EXISTING) = \$2,060.6	
Point-of-use electric hu heaths: (348 xw connected load)	
€ mage = -332,500 galfyr × 8,33 × 89° ×10= Z46,5MBTU	<u> </u>
Some energy = 246.5 MBTU/yr.	
design connected loed = 1,5 g pm x 15 showers + 2 g pm x 2 sinks = 26,5 gp) <i>[</i> /_
$= 1590 gph.$ $f = 6.33 \times 1590 \times (140 - 166) = 1.179 MBTU/M.$	
$= 1590 gph.$ $f = 6.33 \times 1590 \times (140 - 166) = 1.179 \text{ MBTU/M}.$ $= 345 \text{ KW}$	
Average daily peak demand is about 50% of the connected load; = 345 KW/2 = 172.7 KW.	
D4-55	

Annual elec. cost = 246,5 MBTU/gn x \$ 0.0221/KWA
0.003413 MBTU ICWH
+ 172,7 12wdmaml X \$19,50 X12 mo
= \$1,596 (energy) + \$40,412 (demand)
Annual electric cost = #42,008/year.
= (#39,947)/uz.
Point-of-use electric heaters are not feasible. for Building 236.

	E M C ENGINEERS, INC.	SHEET NO.		10 OF 14
	Denver • Colorado Springs • Atlanta • West Germany	CALCULATED BY	-F_	DATE 2/25/92
)	ECO#10	CHECKED BY		DATE
	BLDE 1621 DHW SYSTEM	SCALE		
_	0-DG (62) 21(00 3)31-W			
	Process HW goad data from			w.
	4 photoprocess mac	hines whe 95	Fwater	
	total 22, 80 40 M/WK	egal/week.	for 52 v	ekslyr
	calculate gph of DHW			\
	LISAGE (ZI) PNUESS: 22,800	gal x 1 wk x8	133 B X (75-66)x2080h
		MBTU/yr		
	Toilets: 9 = 154,	142x 45person	s = 6.94	MBTU/y.
	g,= 286,4+ 6	.94= 293.3 M	LBTU/yr.	
	LINE LOSSES (gs)			
	TSTORAGE = 1600	. /	·	1
	WIMIXING VALUE, TSUP	ply at the ton	$k = 140^{\circ}$	'
	Fipe Length BTUH 5130 17. 114 16 23.	Fr 9(BTUH)	
	3/4 130 17.	7 2,3	75	
	1.7	TOT. 2,6	75 BTUH.	=95/70:1ets
	75 miles = 2675 XE760			, , , , , , , , , , , , , , , , , , , ,

JOB WSMR 50157004 #1110-000

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#1621 LONTD.

JOB			
SHEET NO.	······································	ul of	14
CALCULATED BY	TP	DATE	2/25/92
CHECKED BY		DATE	

FOR THE PHOTO PLOCESS, 140 WATER IS MIXED WITH COLD WATER TO GET 95° WATER. WATER CARCULATED CONTINUOUSLY THROUGH THE SUPPLY + RETURN PIPES!

interpolate from table on p. C-

 $q_{TOT} = q_1 + q_3 + q_5 = 293.3 + 7.25 + 70.1 + 23.4$ = 394.1 MBTW/yr.

Some heat = 394.1 = 606.3 mBTW/yr.

ELECTRICAL CONSUMPTION = (+ HP+ + HP) x.746 KW x8760 h= 3,823 KWH

= 13.05 morth/yn. D4-58

E M C ENGINEERS, INC. Denver • Colorado Springs • Atlanta • West Germany SHEET NO. CALCULATED BY CHECKED BY DATE THIS DATE SCALE

Baseline ann energy consumption = GOG. 3 MBTU / + 13.0 MBTU / Letec

= 619,3 MBTU/YR

Baseline ann. energy cost:

9/5 - 606.3 MBTY x #3.423 = \$2,075 MBTH elec - 3,823 ICWH x \$0.0221 + .436 KUX \$19.50 XIZ

= # 186./4. ; TOTIANN COST = 2075+186 = #2,261.

PRUPOSED ECO:

USAGE = 293,3 MBTU/y.

50mce energy = 293,3 MBTU/y = 85,936 KWH.

Demand: Process: 5709ph x 8:33 x (95-66) = 137,695 KBH = 3.413 KBH = 40.3 KW.

Ann. energy wet = 85,936 KW + \times # 0.0221 = # 1899 Ann. demand wer = 40.3 KW \times # 1250 x 12 = # 9,430

ANN ENERGY WIT SAVINGS = \$2,261-11,329 = (#9,06F)

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ECO#10

464 40 gal tank. $\hat{q}_{1} = .154142 \times 42 \text{ people}(MBTM}) = 6.47 \text{ mrstn/y}.$ $\hat{q}_{2} = 2083 \times 42 \times (130-123) \times 10^{-6} = 0.61$ $\hat{q}_{3} = \text{ Alse Table in pb.}$ = 4.69 $\hat{q}_{4} = 2083 \times 12.4 \left(123+130 - 70\right) \times 10^{-6} 141$ = .65 = 15.54 mrstn/y.

392 FT @ 3/4" = 10. F gd.
110 FT @ 1/2" = 11.6 gd.

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JOB	
SHEET NO	14 of 14
CALCULATED BY	TZ DATE 2/24/92
CHECKED BY	

#1794: N=31

 $g_1 = .154142 \times 31 = 4.78 \text{ mBTu/yr}.$ $g_2 = 2083 \times 31 \times 10^{-6} \times (141-136) = 0.32 \text{ mBTy/yr}$ $g_3 = 4.69$ $g_4 = 4.69$

\$4= 2083 × 8.78 × (136+141 -70) ×10=2,17

11.96 mstn/y.
304/1 @ 3/44= 8.4294 -:665=18.4 msty

24 pt @ 12"= 0.36 gol 8.78 gal 4

Blda# 102 153 153 153 153 153 153 153 153 153 153	120 120 120 25 Store 1375 Store 40 40 40 40 40	ma	125 125 130 140 140 136 136	Domestic Steam tolt Domestic	(RULD) (RULD) (RULD) (RULD) (AO Smith) (AO Smith) (IVUD) (AOSmith) (Brodford-White) (Rheem)
3466 6 1 15 15 15 15 15 15 15 15 15 15 15 15 1	00000000000000000000000000000000000000	NOT USED			Rheem (Rheem) (Rheem) (Ruun) (Reliance) (Reliance) (Reliance) (Reliance) (Reliance) (Reliance) (Reliance) (Reliance) (Reliance) (Reliance) (Reliance) (Rheem) (Rheem) (Reliance) (Rheem)
* 1936 summer	40		160 160	Comme	eial •

102 102	Occupants 110		inks 4 Lie	Rathrooms 4 womens 1-1-1-1 4 mens 2-2-1-1
154	129		16 16 16	4, 1st floor 6-6-2-2 4, 2nd floor 6-6-2-2 4, 3rd floor 6-6-2-2 3. Basement 2-2-2
153	18		B 70	Loomen
236	15		8 15 540WE	2 Restrooms (6-2)
254	47.		6	4 restrooms
6 00	35		5 (IJanitors	2-1-1-1
300	281	N 24 - 10		
380	6		12	9 1-1-2-2-1-1
464			7	7 3-1-1-1
1504	100		10	4 3-2-3-2
1506	129		25	3-3-3-3-3
1512	35		18	8 3-2-2-1-3-2-3-2
1526	200		11	7 3-2-2-2-1-1
1528	100		\ \	4 3-3-3-2
1530	225	D4-63	26	10 5-5-2-2-2

Bldo#	Occupants	SINKS I	SATHROOM 2	2-1
1621	45	5	2	3-2
1622	100	25	10	4-3-3-3-2-2-2-
1624	130	25	8	5-5-3-3-5-2-2-
1751	25			4-1
1753	× 1520	4	2	2-2
1790	a 15-20	8	2	6-2
1794	. *	7 (4 showers)	7	5-2 5 mlcs
2440	1	2	2	

E M C ENGINEERS, INC. Denver • Colorado Springs • Atlanta • West Germany	JOB	OF
Pice Length & Size, deferi	miacition_	

For Tuilding 380

On this building, we didn't have a mechanical prind for hol water plumbing. To estimate the length, I followed the drainage piping. These pipes went to each bash, thus accounting for the length,

L=423' => d=1.00"

for the size I had to estimate an aucrose size used to must kuldings

For Builday 153

Determined from Mechanical Murriary Print

L= 173' Pipe Ciec: 1/2"

For Building 124

Determined from Wednica That & Ant

1 1/2"
1/4"
1/4"
10
1"
3/4"
322

	E	M	С	ENGI	N	EERS		INC		
Denver		Colors	ado.	Springe		Atlanta	•	West	Corman	

SHEET NO. 5 OF 12

CALCULATED BY Coddington DATE /-7-9:

CHECKED BY DATE

For Builder 1621

Determined from Plumbing Drawing

Size
3/4"

1.25"

Length
150'

For Evilding 1858

For this I story Building, with no plumbing plans, I took a 3/4" line down the length of the building. This would go to the restrom, kitchen, I dining room. Then a 1/2 in line to each basin.

<u>Size</u> <u>Length</u> 3/4" 171' 1/2" 9'

For Building 1528

There were no plumbing plane for this building. Took a 2" line down length of each floor, A 1" line down length of each floor, and a "6" line to the restrooms.

Size 0" 1/2" Length =7 also took 2" line upboilding =7 rises 48

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JOB WSMR	
SHEET NO.	· 6 of 12
CALCULATED BY	DATE / - 4 - 9 2
CHECKED BY	DATE
SCALE	

For Building 1520

No Plumbing Plans

- · 2' down length
- · 1" down lengthth
- · 1/2" to toilets
- · 2" up risers

For Puilding 1504

No Plumbing Plans

- · 2" down length
- · I'' down length
- · 1/2" to basing
- · 2" uprisers

E	M	C	ENGI	N	EERS	INC	· 'a	
							^	_

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JOB WSMR	
SHEET NO.	7 OF 12
	DATE 1-7-9)
	DATE
CHECKED BY	DATE

For Building 1622

No Plumbing Plans > 3 floors & penthouse

- · 2" down length of each floor Yuprisers
 · 1" down lingth of each floor
 · 1/2" to bathrooms

For Building 1794

No Plumbing Plans > I floor

- ·3/4" down length
- · 1/2" to basing

For Building 260

No. Plumbing Plans > I floor

- · 3/4" down length
- · 1/2" to restrooms

	E	M	C	ENGI	N	EERS	,	INC	•
lenver	• (`olor:	adn	Springs		Atlanta		West	Germany

JOB WEMP	
SHEET NO.	8 of 12
_	DATE 1-7-92
CHECKED BY	
SCALE	

For Building 236

No Plumbing Plans

- · 2" line down length & uprisers
- · I" line down leigth
- · 1/2' line to basins

For Proliting 4/64

No Planking Plans - 1 floor

- · 3/4" line down length
- · 1/2" Ine to basing

<u>Leng4</u> 392 110

For Building 254

No Plumbing Plans - 2 Plans 5

- · 2" down length.
- · I" down length
- · 1/2" to basins

	JOB WSMR	_		
E M C ENGINEERS, INC.	SHEET NO		DF 12 DATE 1-7-92	
Denver • Colorado Springs • Atlanta • West Germany	CALCULATED BY CHECKED BY		DATE	
	SCALE			
For Building 102		-		
No Plunbing Plans				
. 111 line down lei	gth Yupmsers			
· 1/2" line to basin	0		,	
	,			
<u> </u>	Length			
$\frac{\partial r}{\partial x}$	28 2 24 1			
1/2 1	172			
For Building 1751	•			
No Plumbing Plans -1	Plane			`
100 Hombing Havis				
3/10/10/1				
• 3/4 " down lengt i • 1/2 " to basins				

Size 3/4'

<u>Length</u> 225 52

For Building 1752

No Plumbing Plans- 1 floor

· -14" down leigth

· 1/2" to busins

3/41

Length 178 15

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JOB WSMP	
SHEET NO.	10 of 12
CALCULATED BY KC	DATE Jan 7
CHECKED BY	DATE
SCALE	

For Building 1512

No Plumbing Plans

- · 2" line down length of up risers
- · I" line down length
- · 1/2" line to bases

For Building 1506

No Plumbing Plans

- · 2" line down length tup risers
- · I" line down length
- · 1/2" line to bosins

	JOB (1) S ME)			
E M C ENGINEERS, INC.	SHEET NO.			
Denver • Colorado Springs • Atlanta • West Germany	CALCULATED BYKC	DATE		
	CHECKED BY	DATE		
	SCALE			
For Building 1624				
From Plans				
Eas! Wing				
<u>Size</u>	Length			
,	101			
North Y South Wing 5				
Size	Length 174			
	174			
For Building 1526				
No Plumbing Plans				
· 2' line down length	h Y up risers			
· I" line down lengi-				
· 1/2" line to basins				
<u> Dize</u>	Length			
a " / "	340 320			
1/2 "	64			
For Building 1790				
No Plumbing Plans				
· 2" line down length	+up Risers - Size	Lerath		
· l'Ince down long the		440		

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JOB WSMC	
SHEET NO.	12 of 12
CALCULATED BY	DATE 1-7-92
CHECKED BY	DATE
2041	

For Building 300

Original & Wirgs > No Plunding Plans

- · 2" down length & up Risers
- · I' line down length
- · 1/2" line to basins

Original - South Wing

East & West Wings

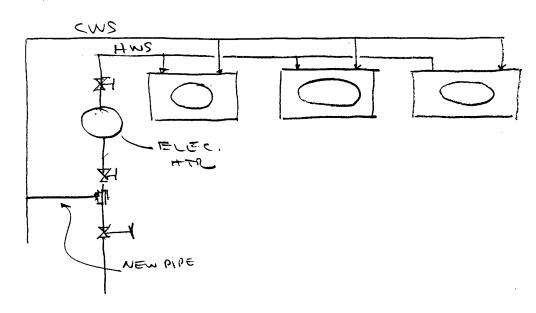
JOB	WS	MR	E205	YOURS	#1110	-000
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E M C ENGINEERS, INC.

ECO #10! ELEC. POINT-OF SCALE USE WATER HEATERS

TYPICAL INSTALLATION



APPORTENACE MATERIAL & LABOR PER INSTALLATION (MOHOP) Sounce ! MEANS MECH , ELEC COST GOIDES 1892.

TOTAL WIST W/O HEATER PERINSTALLATION \$48800

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JOB	
SHEET NO	2 of <u>b</u>
CALCULATED BY	DATE 2/24/92
CHECKED BY	DATE
SCALE	

HEAT LOAD:

1 BASIN (OFFICE BLDG)
$$\dot{q} = 2gph \times 8.33 LB \times (140-66) = 1233 BTUH

1 Service since

 $\dot{q} = 2ugph \times 8.33 \times (74) = 12.324 BTUH

3.61 KW

1 SHOWER (BYM)

 $\dot{q} = 225 \times 8.33 \times (74) = 136.45 BTUH

40.6 KW.$$$$

102	OCCUPANTS	RestRM Women's 4@ MEN 4@ Servisink 2@	Sinks 4 6	6 PM 6 PM • 133 • 20	2.17	# HTRS 4 4 2
124	129	RR 60 RR 60 RR 60 Sew. Sniks 60	1 2 3	.066	0.36 0.72 1.08 3.61	3 666
153	18	1@ 1@ Serv. sink 1@	/ 3 I	.033	0,36 1.08 3,60	1
236		mon's { @ woman's { @ \$1.00 Servicine 0	2 showers	0.29 4.33 .067 .067	530 8.0	
254	47	20 20 Service snik 20	2 sinks	.067	0.72 0,36 3.61	2 2 2

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SHEET NO. 3 OF 6

CALCULATED BY TP DATE 2/21/92

CHECKED BY DATE

BUDA	# OCCUPANTS	Rest Rus Sink	HTR GPM	HT2 162	# HTRS
260	35	4@1	0,033	0.36	4
_		Sevice Sink 1	. 333	3.61	1
300 8	1	3 @ 2 3 @ 1 3 Der v. Sinks	.067	0.72	3 3 3
300 S	281	t @ 3 3 serve sink	. 333	1,08 3,61	3
300 W		3 servisink	- 333	3.41	3
		3 @ 2 3 @ 1	.667 .033	0.72	3 3
380	6	3 @ Z	0,067	0,72	3
70	•	60 1	0,033	0,36	6
		1 Service Sink	0.333	3.61	1
464		4 @ 1	0.033	0.36	4
, ,	122	1 @ 3	0,100	1.08	1
		1 suvi a sink	0,333	3.61	1
15:04	100	2@ 3	0,100	1.08	Z
		20 2	0.067	0.72	2
		1 service sink	0.333	3.61	And the state of t
1506	129	50 2	0.067	0.72	5
		50 3 z servicis inles	0.100	1.08	5 -
1512	35	3@ 3	0.100	1,08	3
, – .,		4@ 2	0.067	0.72	4
		 @	0,033	0.36	1
		3 service sinks	0.333	3,61	3

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JOB	The state of the s
SHEET NO.	H OF 6
CALCULATED BY	TF DATE 2/24/92
CHECKED BY	DATE
CHECKED BY	

BUD6	#ccupanos	Rist Sinks	HITE	HTR	# HT725
1526	200	4 @ 2	0.067	0.72	4
		30 1 6 suvigs	0.033 inls .333	0.36	3
1528	100	1 @ 4	0.133	1.45	1
, •••		1@3	0.100	1.08	1
		2 @ 2 4 servicio si	0.067 NCS .333	0.72 3.61	2 4
1530	225	2@5	0,165	1.80	2.
/33		8(0 2	0.067	0,72	CO
		6 service se	nics ,333	3,61	6
		4 Photo machine	@ 0,933gp	m 10.1 KW	4
155 8		101	0,067	0,72	1
		1 services	ml 0.333	3.61	
1621	45	4 photo machin	0.10 0.067	1.08	
		1 & 2 1 service sir		3.61	
1622	100	1 @ 4	0,133	1.45	1
		3 @ 3 6 @ Z	001,00	1.08	3
		6 Aeroia si			6
1624	130	205	0.165	1.80	. 2
,	•	303	0.100	1.08	3
		302	0.067	0,72	3
		6 service sent	\$ 6.333	3.61	6

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JOB	
SHEET NO.	5 OF 6
CALCULATED BY	DATE
CHECKED BY	DATE
20415	

BLDG	#OCCUPANTS	Lest Rm Sinks	HTR 6PM	HTR	# HTU
1751	25	1 @ 4	0./33	1,45	1
1753	18	2 @ 2 1 xuvià sui	0.067	3,61	2
/790	18	2 @ 4 1 suria mik	0,133 0,333	1.45 3,61	
1794	31	1@4+2 showers 1@3+2 showers 1 Service smile	7,63 7,60 0.333	82,6 82,3 3,61	, 1

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ECD #10: BLOG P124

JOB WSMR ESOS	#1110-000
SHEET NO.	1 of 2
CALCULATED BY TJF	DATE 6/11/92
CHECKED BY	•
SCALE	

DATA SOURCE -	BUILDING MANAGER	# HEATTERS	(ILW)	CATALUS SIZE (ICW)
BASEMENT	3 KB @ 1 21 MK	3	0,36	1
FIRST FLOOR	2 RR @ 2 SINKS	2	0.72	1
	Z RR@ 35/NK	2	3.6	3
	2 SERVICE SIMUS	2	0.36	1
sewnd fll	2 RR @ 2 31MKS	2	0.72	1
	2 RR@ 3 51 NKS	2	1.08	1
	2 servicesinks	2	3.6	3
THRD FLR	2 RR@ 2 SIND	2	0.72	1
	~ Kr (0 3 21 nx2	2	1.08	1
	S SERVICE SINKS	2	3.6	3
	TOTAL	21		

15 HEATERS @ 1 KW

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ECO #10; BLDG P124

JOB WSMR ESOS	# 1110-000
SHEET NO.	Z 0F Z
CALCULATED BY	DATE 6/11/92
CHECKED BY	DATE

ELECTRICAL ENERGY SAVINGS CALCULATIONS;

1/2 HP DUMP X 0.746 KW X 8760 HR = 555 KWh/Yr.

1/6 HP DUMP X 0.746 X 8760 = 1,111 KWh/Yr

TOTAL DUMP ELEC ENERGY SANGD = 1,666 KWh/Yr

CONSUMPTION OF FLEC WATER HEATENS!

Total ADMIAN KWH SAVED = 1,666 - 5,026 = 4,160 kWh /UN ×.003413 MBty = (14,2 MBty)

E M C ENGINEERS, INC.

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三CU #10

JOB WSMK ESOSSTUDY	#1110-000
SHEET NO.	6 OF 6
CALCULATED BYT	DATE 2/24/92
CHECKED BY	DATE
SCALE	

SIZING ELEC POINT-OF-USE HEATERS.

REF: ASHRAE 1991 APPLICATIONS HB, SECT 44, TABLE 8.

44.14

1991 Applications Handbook

Table 8 Hot Water Demand per Fixture for Various Types of Buildings (Gallons of water per hour per fixture, calculated at a final temperature of 140°F)

	Apartment House	Club	Gym- nasium	Hospital	Hotel	Industrial Plant	Office Building	Private Residence	School	
1. Basins, private lavatory	2	2	2	2	2	(2)	(2)		3611001	IMCA
2. Basins, public lavatory	4	6	8	6	8	4	$\binom{2}{6}$	2	2	1
3. Bathtubs	20	20	30	20	20		<u>`</u>	20	15	×
4. Dishwashers ^a	15	50-150	_	50-150	50-200	20-100		-		30
5. Foot basins	3	3	12	3	30-200	12		15	20-100	20-100
6. Kitchen sink	10	20		20	30	20	20	,	3	12
7. Laundry, stationary tubs	20	28	_	28	28		20	10	20	20
8. Pantry sink	5	10		10	10	_	10	20	_	28
9. Showers	30	150	225)	75	75	225	30	20	10	10
10. Service sink	20	20		20	30	20	(20)	30 15	225	225
11. Hydrotherapeutic showers				400	50	20	رف	13	20	20
12. Hubbard baths				600						
13. Leg baths			•	100						
14. Arm baths				35						
15. Sitz baths				30						
16. Continuous-flow baths				165						
17. Circular wash sinks				20	20	30	20		30	
18. Semicircular wash sinks				10	10	15	10	15	30	
19. DEMAND FACTOR	0.30	0.30	0.40	0.25	0.25	0.40	0.30	0.30	0.40	_
20. STORAGE CAPACITY FACTOR ^b	1.25	0.90	1.00	0.60	0.80	1.00	2.00	0.30	0.40 1.00	0.40 1.00

Dishwasher requirements should be taken from this table or from manufacturers' data for the model to be used, if this is known.

19. The heater or coil should have a water-heating capacity equal to this probable maximum demand. The storage tank should have a capacity equal to the probable maximum demand multiplied by the storage capacity factor in line 20.

affecting the spray pattern of the shower head. Flow control valves are commonly available in capacities from 1.5 to 4.0 gpm.

If the manufacturer's flow rate for a shower head is not available and a flow control valve is not used, the following may serve as a guide for sizing the water heater:

> Small shower head Medium shower head Large shower head

Ratio of storage tank capacity to probable maximum demand/h. Storage capacity may be reduced where an unlimited supply of steam is available from a central street steam system or large boiler plant.

		LOCATION. ME		_				
		LOCATION: White		9 Hange 743 – ENERGY EFFICIE	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		DISCRETE PORTI		TOTAL	MILIGHING		FISCAL YEAR:	1992
		ANALYSIS DATE:	06/09/92	TOTAL	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
			00,00,02		EGGITOMIO EM E.	20	THE ANCOUT.	A. GIOVEN
1	IN۱	/ESTMENT						
	A.	CONSTRUCTION	COST	=			\$26,824	. •
	В.	SIOH COST		(5.5% of 1A) =			\$1,475	
	C.	DESIGN COST		(6.0% of 1A) =			\$1,609	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$29,909	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D – 1E) =			>	\$29,909
•	EN	EDGV SAVINGS (.)	(COST ()					
2	EIA	ERGY SAVINGS (+) FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ÉLEC	\$6.48	119	\$772	15.23	\$11,765	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	0	\$0	19.64	\$0	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		119	772.5		> >	\$11,765
_								
3		N-ENERGY SAVIN						
	A.		, , ,	C. DEMAND SAVINGS)	- (Form 7:11 A A)		\$3,701	
		1 DISCOUNT FAC 2 DISCOUNTED S		OST (-)	(From Table A-2) =	14.68	#54.000	
	В.	NON-RECURRING		031 (-)	(3A x 3A1) =		\$54,333	
		ITEM	- ()		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0	``	0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		. \$0		0.00	\$0	
		d TOTAL		\$0			\$0	
				TED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$54,333
	D.	PROJECT NON-E						
		1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$3,882	
		a IF 3D1 => 3C T b IF 3D1 < 3C Th	*	TE QID		(0EE + 2D4) / 4E -	0.50	
		c IF 3D1b => 1 T		i L Oiri		(2F5 + 3D1) / 1F =	0.52	-
				DOES NOT QUALIFY				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) / (COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$4,474
5	то	TAL NET DISCOUN	ITED SAVINGS			(2F5 + 3C) =		\$66,098
6				MENT RATIO (SIR)		(5/1F) =		2.21
_		SIR < 1 THEN PRO		OT QUALIFY)				
7	SIN	MPLE PAYBACK (SP	'B)			(1F/4) =		6.69

				_		_		
		LOCATION: Whit		•	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				751 - ENERGY EFFICIE	ENT LIGHTING		FISCAL YEAR:	1992
		DISCRETE PORTK		TOTAL	50011011101155		222122222	A OTOVER
		ANALYSIS DATE:	06/09/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
4	IAN	/ESTMENT						
'		CONSTRUCTION	COST	_			\$9,515	
		SIOH COST	0001	(5.5% of 1A) =		•	\$523	
		DESIGN COST		(6.0% of 1A) =			\$571	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$10,609	
		SALVAGE VALUE		(18.7.15.7.10)=			\$0	
		TOTAL INVESTME	NT	(1D - 1E) =			>	\$10,609
	••	TOTAL INVESTIGE		(10 - 12) -				\$10,550
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)		SAVINGS (5)	
	A.	ELEC	\$6.48	38	\$248	15.23	\$3,743	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	0	\$0	19.64	\$0	
	D.	PAPER		0	\$0	•	\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		38	245.8		>	\$3,743
3	NO	N-ENERGY SAVIN	GS (+) / COST ((-)				
	A.	ANNUAL RECURA	ING (+/-) (ELE	C. DEMAND SAVINGS)	=		\$1,177	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	AVINGS (+) / C	OST (-)	$(3A \times 3A1) =$		\$17,286	
	В.	NON-RECURRING	à (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		C.	·	\$0		0.00	\$0	
	_	d TOTAL		\$0			\$0	
				ITED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$17,286
	D.	PROJECT NON-E						
		1 25% MAXIMUM				(2F5 x 0.33) =	\$1,235	
		a iF 3D1 => 3C 1				(222 22.01.12		
		b IF 3D1 < 3C TH		I E SIR		(2F5 + 3D1) / 1F =	0.47	
		c IF 3D1b => 1 T		DOES NOT QUALIEY				
		u 1 - 3010 < 1 1 F	IEN FRUJECT	DOES NOT QUALIFY				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$1,423
5	то	TAL NET DISCOUN	TED SAVINGS			(2F5 + 3C) =		\$21,0 28
6	DIS	SCOUNTED SAVING	S-TO-INVEST	TMENT RATIO (SIR)		(5/1F) =		1.98
	(IF	F SIR < 1 THEN PRO	DJECT DOES N	IOT QUALIFY)				
7	SIN	MPLE PAYBACK (SP	PB)			(1F/4) =		7.45

		LOCATION: Whit	a Sande Missila	Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				753 – ENERGY EFFICIE		7	FISCAL YEAR:	1992
		DISCRETE PORTIC		TOTAL			TIOOAL TEAT.	.002
		ANALYSIS DATE:	06/09/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IN۱	VESTMENT						
	A.	CONSTRUCTION	COST	=			\$7,396	
	В.	SIOH COST		(5.5% of 1A) =			\$407	
	C.	DESIGN COST		(6.0% of 1A) =			\$444	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$8,247	
	E.	SALVAGE VALUE					\$0	
	F.	TOTAL INVESTME	:NT	(1D - 1E) =			>	\$8,247
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
		ELEC	\$6.48	27	\$174	15.23	\$2,652	
		DIST		0	\$0	17.28	\$0	
		NAT GAS	\$2.21	0	\$0	19.64	\$0	
		PAPER		0	\$0		\$0	
		COAL		A**	\$0	16.22	\$0	40.444
	F.	TOTAL		27	174.1		>	\$2,652
2	NC	N-ENERGY SAVIN	GS (A) / COST /	'_				
J				C. DEMAND SAVINGS)	_		\$834	
	۸.	1 DISCOUNT FAC		o. Demand Caringo,	(From Table A-2) =	14.68	4004	
		2 DISCOUNTED S		OST (-)	(3A x 3A1) =	14.00	\$12,246	
	В.	NON-RECURRING			(,		*	
		ITEM	. ,		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		C.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENE	RGY DISCOUN	ITED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$12,246
	D.	PROJECT NON-E						
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$875	
		a IF 3D1 => 3C				1		
	٠	b IF 3D1 < 3C TI		TE SIR		(2F5 + 3D1) / 1F =	0.43	
		c IF 3D1b => 1 7						
		a 1F3D1b<1T	1EN PROJECT	DOES NOT QUALIFY				•
	E11	BET VEAD DOLLAR	SAVINGS (A. C.	COSTS (.)	10-0	. 04 . (0D4-2/07)		A
		RST YEAR DOLLAR OTAL NET DISCOUN			(2F3	+ 3A + (3B1d/25)) =		\$1,008
				MENT RATIO (SIR)		(2F5 + 3C) = (5/1F) =		\$14,898 1.81
J		F SIR < 1 THEN PR				(3/17) =		1.01
7		MPLE PAYBACK (SF		wormin ij		(1F/4) =		8.18
·			-,			(1174) =		0.10

		LOCATION: Whi		•	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				1790 – ENERGY EFFICIE	INT LIGHTING		FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/09/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1		VESTMENT						
	A.		COSI				\$9,643	
	₿.			(5.5% of 1A) =			\$530	
	C.	DESIGN COST ENERGY CREDIT		(6.0% of 1A) =			\$579	
				(1A + 1B + 1C) =			\$10,752	
		SALVAGE VALUE TOTAL INVESTME	**IT	45 4E			\$0	
	۲.	IOTAL INVESTME	:NI	(1D – 1E) =			 >	\$10,752
2	EN	ERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	57	\$369	15.23	\$5,624	
	₿.	DIST	•	0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	0	\$0	19.64	\$0	
	D.	PAPER			\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		57	369.3		>	\$5,624
				•				
3	NO	N-ENERGY SAVIN	GS (+) / COST ((-)				
	A.	ANNUAL RECURF	ING (+/-) (ELEC	C. DEMAND SAVINGS)	*		\$1,769	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	AVINGS (+) / C	OST (-)	(3A x 3A1) =		\$25,973	
	B.	NON-RECURRING	à (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
				TED SAVINGS (+) / COS	T ()	(3A2 + 3Bd4) =		\$25,973
	D.	PROJECT NON-E						
		1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$1,856	
		a IF 3D1 => 3C 1						
		b IF 3D1 < 3C TH		TE SIR		(2F5 + 3D1) / 1F =	0.70	
		c IF 3D1b => 1 T			•			
		d IF 3D1b < 1 TF	IEN PROJECT I	DOES NOT QUALIFY				
4	FIR	ST YEAR DOLLAR	SAVINGS (+) / (COSTS (-)	(2F3	+ 3A + (3B1d/25)) =	•	\$2,139
		TAL NET DISCOUN			•	(2F5 + 3C) =		\$31,597
6	DIS	COUNTED SAVING	iS-TO-INVEST	MENT RATIO (SIR)		(5/1F) =		2.94
	(IF	SIR < 1 THEN PRO	DJECT DOES N	OT QUALIFY)				
7	SIM	IPLE PAYBACK (SP	B)			(1F/4) =		5.03

		LOCATION: WE	ha Oanda Missil	- D	DEGION.	•	. DDG IFOT NO.	
		LOCATION: Whit		e Hange 1794 – ENERGY EFFICIE	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
					INILIGHTING		FISCAL YEAR:	1992
		DISCRETE PORTION ANALYSIS DATE:	06/09/92	TOTAL	ECONOMIC LIEE.	05	DOCUMENTO DV.	A CTOVED
		ANALISIS DATE.	00/09/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	١N١	VESTMENT						
·		CONSTRUCTION	COST	=			\$24,962	
		SIOH COST		(5.5% of 1A) =			\$1,373	
		DESIGN COST		(6.0% of 1A) =			\$1,498	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$27,833	
		SALVAGE VALUE		(17.1.101.10)=			\$0	
		TOTAL INVESTME	NT	(1D - 1E) =			>	\$27,833
	• •		•••	(15 - 12) -				Ψ27,000
2	ΕN	IERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	135	\$875	15.23	\$13,322	
	B.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	0	\$0	19.64	\$0	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		135	874.7		>	\$13,322
3	NC	N-ENERGY SAVIN	GS (+) / COST	(-)			-	
	A.	ANNUAL RECURF	RING (+/-) (ELE	C. DEMAND SAVINGS)	=		\$4,191	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	SAVINGS (+) / C	OST (-)	(3A x 3A1) =		\$61,523	
	В.	NON-RECURRING	G (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	_			NTED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$61,523
	D.	PROJECT NON-E						
		1 25% MAXIMUM				(2F5 x 0.33) =	\$4,396	
		a IF 3D1 => 3C1						
		b IF 3D1 < 3C TI				(2F5 + 3D1) / 1F =	0.64	
		c IF 3D1b => 1 T	-					
		a 11-3D1b<1Th	1EN PROJECT	DOES NOT QUALIFY				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$5,066
		TAL NET DISCOUN			(2.0	(2F5 + 3C) =		\$74,845
				TMENT RATIO (SIR)		(5/1F) =		2.69
		F SIR < 1 THEN PRO				(2, ., , =		2.03
7		MPLE PAYBACK (SF		•		(1F/4) =		5.49
		•				(···//) -		5.48

		LOCATION: Whit		· ·	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				1830 – ENERGY EFFICIE	NT LIGHTING		FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/09/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	iN۱	VESTMENT						
		CONSTRUCTION	COST	=			\$12,211	
	В.	SIOH COST		(5.5% of 1A) =			\$672	
		DESIGN COST		(6.0% of 1A) =			\$733	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$13,615	
		SALVAGE VALUE					\$0	
		TOTAL INVESTME	NT	(1D - 1E) =			>	\$ 13,615
				,				
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	46	\$296	15.23	\$4,505	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	0	\$0	19.64	\$0	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		46	295.8		>	\$4,505
3	NC	N-ENERGY SAVIN	GS (+) / COST	(-)		•		
	A.	ANNUAL RECURR	ING (+/-) (ELE	C. DEMAND SAVINGS)	=		\$1,417	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	AVINGS (+) / C	:OST (-)	(3A x 3A1) =		\$20,807	
	В.	NON-RECURRING	à (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
				ITED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$20,807
	D.	PROJECT NON-E						
		1 25% MAXIMUM	NON-ENERG	Y CALCULATION		$(2F5 \times 0.33) =$	\$1,487	
		a IF 3D1 => 3C 1						
		b IF 3D1 < 3C Ti				(2F5 + 3D1) / 1F =	0.44	
		c IF 3D1b => 1 T						
		d IF 3D1b < 1 Th	IEN PROJECT	DOES NOT QUALIFY				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$1,713
		TAL NET DISCOUN			•	(2F5 + 3C) =		\$25,312
6	DIS	SCOUNTED SAVING	S-TO-INVES	TMENT RATIO (SIR)		(5/1F) =		1.86
		F SIR < 1 THEN PRO						
7	SIN	MPLE PAYBACK (SF	PB)			(1F/4) =		7.95
		•				• •		

		LOCATION: Whit	te Sands Missil	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				1845 – ENERGY EFFICIE	ENT LIGHTING		FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/09/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IN۱	VESTMENT						
	A.	CONSTRUCTION	COST	=			\$281	
	В.	SIOH COST		(5.5% of 1A) =			\$15	
	C.	DESIGN COST		(6.0% of 1A) =			\$17	
	D.	ENERGY CREDIT		(1A+1B+1C)=			\$ 313	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	ENT	(1D - 1E) =			>	\$313
2	EN	ERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
		ELEC	\$6.48	1	\$7	15.23	\$112	
		DIST		0	\$0	17.28	\$0	
		NAT GAS	\$2.21	0	\$0	19.64	\$0	
		PAPER		0	\$0		\$0	
		COAL			\$0	16.22	\$0	
	F.	TOTAL			7.3		>	\$112
3	NO	N-ENERGY SAVIN	GS (+) / COST	(-)				
Ĭ				C. DEMAND SAVINGS)	_		\$ 35	
		1 DISCOUNT FAC		o. Demarto Carrido,	(From Table A-2) =	14.68	433	
		2 DISCOUNTED S		COST (-)	(3A x 3A1) =	14.00	\$ 51 5	
	В.	NON-RECURRING			(0/1 / 0/11) =		4010	
		ITEM	- ()		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0		0.00	\$0	
	C.	TOTAL NON-ENE	RGY DISCOUN	TED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =	4 •	\$515
		PROJECT NON-E		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		(0.2.022.)		40.0
		1 25% MAXIMUM	NON-ENERGY	Y CALCULATION		(2F5 x 0.33) =	\$37	
		a IF 3D1 => 3C 1	THEN GO TO 4			(=: -: :: -: -: -;	40.	
		b IF 3D1 < 3C Th	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =	0.47	
		c IF 3D1b => 1 T	HEN GO TO 4			(======================================		
		d IF 3D1b < 1 TF	HEN PROJECT	DOES NOT QUALIFY				
	-	NOT VELD DA : : =	6 11 (1) (6 5 1 1 1 1					
		RST YEAR DOLLAR		• •	(2F3	+ 3A + (3B1d/25)) =		\$42
		TAL NET DISCOUN				(2F5 + 3C) =		\$627
6				TMENT RATIO (SIR)		(5/1F) =		2.00
-10		SIR < 1 THEN PRO		NOT QUALIFY)				
7	SIN	MPLE PAYBACK (SP	'B)			(1F/4) =		7.38

		CONSTRUCTION COST ESTIMATE BREAKDOWN	: BREAKD(NMC							
CONTE	CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SOI	JTH WADSW	ORTH BLVI	D., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	O 80227	
SONTE	RACT FO	CONTRACT FOR (WORK to be performed) ENERGY EFFICIENT LIGHTING IN BLDG. 1743	743					PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
PURC	HASE RE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	ВЕЯ		WORK LOCATION WHITE SAN	WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
					MATERIAL COST	L cost		LABOR COSTS			
	Line	Item	g Ç	Quantity			Manhours	Average		Other Direct	Line
Z	ON	(5)	Measure (2)	ල	G. G.	Total (5)	Mandays (6)	Rate (7)	Total (8)	Costs (9)	Total (10)
		INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
		4 FT. ENERGY EFFICIENT LAMPS	EA	146	2.19	319.74	0.09	27.60	354.60	·	\$674.34
		8 FT. ENERGY EFFICIENT LAMPS	EA	114	5.12	583.68	0.09	27.6	276.88		\$860.56
		ENERGY EFFICIENT BALLASTS									
)5-9		2-LAMP (4') FIXTURE BALLAST	EA	73	14.06	1026.38	0.85	27.6	1714.59		\$2,740.97
		2-LAMP (8') FIXTURE BALLAST	EA	57	29.68	1691.76	0.85	27.6	1338.79		\$3,030.55
		8 FT, 2-TUBE FLUORESCENT FIXTURES	EA	70	141.24	9886.80	1.82	27.6	1932.00		\$11,818.80
		LIGHTING BRANCH CIRCUITS	EA	7	LABOR AN 930.45	LABOR AND MATERIALS 930.45 6513.15					\$6,513.15
		DEMOLITION	EA	118	LABOR AN 10.05	LABOR AND MATERIALS 10.05 1185.90					\$1,185.90
		TOTAL THIS SHEET									\$26,824.29
	-	Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM-61-1 and Includes Overhead & Profit	erhead & Profit; L	abor Source: U.S	. Dept. of Labor,	General Wage Decision	on No. NW-91-1 an	d Includes Overhes	d & Profit		

	CONSTRUCTION COST ESTIMATE BREAKDOWN	: BREAKDC	NWC							
CONTRACTOR	eMC ENGINEERS INC.			ADDRESS 2750 SOU	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	ORTH BLVI)., #C-200,	DENVER, CO	D 80227	
CONTRACT	CONTRACT FOR (WORK to be performed) ENERGY EFFICIENT LIGHTING IN BLDG. 1751	751					PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	DS MISSILE	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	L cost		LABOR COSTS			
Line	Item	o Crit	Quantity			Manhours	Average		Other Direct	Line
S	Έ)	Measure (2)	ල	Unit €	Total (5)	Mandays (6)	Rate	Total (8)	Costs (9)	Total (10)
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT, ENERGY EFFICIENT LAMPS	EA	398	2.19	871.62	0.09	27.60	966.66		\$1,838.28
	8 FT, ENERGY EFFICIENT LAMPS	EA	6	5.12	30.72	0.09	27.60	14.57		\$45.29
	ENERGY EFFICIENT BALLASTS									
	2-LAMP (4') FIXTURE BALLAST	EA	199	14.06	2797.94	0.85	27.60	4674.03		\$7,471.97
	2-LAMP (8') FIXTURE BALLAST	EA	က	29.68	89.04	0.85	27.60	70.46		\$159.50
	TOTAL THIS SHEET									\$9,515.05
	Material Source: Lightbuib Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM-91-1 and Includes Overhead & Profit	verhead & Profit; L	abor Source: U.S.	. Dept. of Labor,	General Wage Decision	M No. NM-91-1 and	Includes Overhead	i & Profit		

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKD(NMC				Form Approved			
							Budget Bureau No. 22-R-100	22-R-100		
CONTRACTOR	ron EMC ENGINEERS INC.			ADDRESS 2750 SOL	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	ORTH BLVI	J., #C-200,	DENVER, CC	J 80227	
CONTRACT	CONTRACT FOR (Work to be performed) ENERGY EFFICIENT LIGHTING IN BLDG. 1753	753					PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE. NE	W MEXICO
				MATERIAL COST	LCOST		LABOR COSTS			
Line	He <u>t</u>	Çajît O	Quantity			Manhours	Average		Other	-
Š.	Œ	Measure	€	Quit	Total	Mandays	Rate	Total	Costs	Total
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS	E)	6		6		5	6	0	6.)
	4 FT. ENERGY EFFICIENT LAMPS	EA	99	2.19	144.54	0.09	27.60	160.30		\$304.84
	ENERGY EFFICIENT BALLASTS	EA	33	14.06	463.98	0.85	27.60	775.09		\$1,239.07
	METAL HALIDE FIXTURES & LAMPS	EA	12	308.40	3700.80	0.33	27.60	331.20		\$4,032.00
	LIGHTING BRANCH CIRCUITS	Ð	2	LABOR AN 779.52	ABOR AND MATERIALS 779.52 1559.04					\$1,559.04
	DEMOLITION	EA	26	LABOR AN 10.05	LABOR AND MATERIALS 10.05 261.30					\$261.30
		:								
	TOTAL THIS SHEET									\$7,396.25
	Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NIM-91-1 and Includes Overhead & Profit	erhead & Profit; L	abor Source: U.S	Dept. of Labor,	Beneral Wage Decisio	n No. NM-91-1 and	Includes Overhead	& Profit		

Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM-91-1 and Includes Overhead & Profit

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NWC				-			
CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SOU	ADDITESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO	ORTH BLVI	D., #C-200,	DENVER, C	0 80227	
CONTRACT F	CONTRACT FOR (Work to be performed) ENERGY EFFICIENT LIGHTING IN BLDG. 1790	790					PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE F	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	IDS MISSILE	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	L COST		LABOR COSTS			
Line	Item	of life	Quantity			Manhours	Average		Other Direct	Line
Ö N	(1)	Measure (2)	ම	S (4)	Total (5)	Mandays (6)	Rate	Total (8)	Costs (9)	Total (10)
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS						,			
	4 FT. ENERGY EFFICIENT LAMPS	EA	40	2.19	87.6	60.0	27.60	97.15		\$184.75
	ENERGY EFFICIENT BALLASTS	Ą	20	14.06	281.20	0.85	27.60	469.75		\$750.95
	REPLACE EXISTING 400-WATT INCANDESCENTS WITH 325-WATT METAL HALIDE LAMPS									
	METAL HALIDE FIXTURES & LAMPS	EA	84	86.75	7287.00	0.33	27.60	765.07		\$8,052.07
	EXISTING INCANDESCENT REMOVAL	EA	84			0.17	27.60	394.13		\$394.13
	DEMOLITION	EA	26	LABOR AN 10.05	LABOR AND MATERIALS 10.05 261.30					\$261.30
	TOTAL THIS SHEET									\$9,643.20
	Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM-91-1 and Includes Overhead & Profit	erhead & Profit; L	abor Source: U.S	. Dept. of Labor,	General Wage Decksk	on No. NM-91-1 an	d Includes Overhead	s & Profit		

D5-12

	CONSTRUCTION COST ESTIMATE BREAKDOWN	: BREAKD(NMC				·			
CONTRACTOR	on EMC ENGINEERS INC.			ADDRESS 2750 SO	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	ОВТН ВСУС)., #G-200,	DENVER, CO	J 80227	
CONTRACT	CONTRACT FOR (WORK to be performed) ENERGY EFFICIENT LIGHTING IN BLDG, 1794	794					PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
				MATERIAL COST	LCOST		LABOR COSTS			
Line	Item	of Chit	Quantity			Manhours	Average		Other Direct	Line
Š.	(1)	Measure (2)	· •	G Grit	Total (5)	Mandays (6)	Rate	Total (8)	Costs	Total (10)
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS			,						
	4 FT. ENERGY EFFICIENT LAMPS	EA	12	2.19	26.28	0.09	27.60	29.15		\$55.43
	ENERGY EFFICIENT BALLASTS	EA	9	14.06	84.36	0.85	27.60	140.93		\$225.29
	250-W METAL HALIDE FIXTURES & LAMPS	Ę	48	308.4	14803.20	Æ	65.14	3126.72		\$17,929.92
D5-1	LIGHTING BRANCH CIRCUITS	EA	8	LABOR AN 723.36	LABOR AND MATERIALS 723.36 5786.88					\$5,786.88
3	DEMOLITION	EA	96	LABOR AN 10.05	LABOR AND MATERIALS 10.05 964.80					\$964.80
	TOTAL THIS SHEET									\$24,962.31
	Material Source: Lighthuith Sunnin Co. Danver CCP Private Include 258, Oachead & Profit: Labor Source: List Boot distance Danver Danver CCP Private Includes Death Danver List Boot distance List Boot distance Danver Danv	arhead & Profit-	ohor Courses 11 6	Dank of phone	Concest When Desired	~ Ath Miss_01_1 and		1		

Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit, Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM-91-1 and Includes Overhead & Profit

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NWC							
CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SOL	JTH WADSW	ORTH BLVI	J., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	O 80227	
NITRACT F	CONTRACT FOR (WORK to be performed) ENERGY EFFICIENT LIGHTING IN BLDG. 1830	830					PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
URCHASER	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
				MATERIAL COST	LOST		LABOR COSTS			
Line	ltem	Criit of	Quantity	1	1992	Manhours	Average	F F	Other	Line
2	(1)	Medsure (2)	(3)	₹ €	(5)	malidays (6)		(8)	8 (6)	(10)
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	522	2.19	1143.18	0.09	27.60	1267.83		\$2,411.01
	ENERGY EFFICIENT BALLASTS	VЭ	261	14.06	3669.66	0.85	27.60	6130.26	·	\$9,799.92
	TOTAL THIS SHEET									\$12,210.94
	Material Source: Lightbuib Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM-91-1 and Includes Overhead & Profit	verhead & Profit; L	abor Source: U.S	t. Dept. of Labor,	General Wage Decks	on No. NM-91-1 an	d Includes Overhead	d & Profit		

D5-14

	725		WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO		Other Direct Line			\$55.43	\$225.29						_
	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	CONTRACT PRICE	DS MISSILE RAN		8 5	Total Cc (8)		29.15	140.93						
	D., #C-200, I	PROPOSED TOTAL CONTRACT PRICE	WORK LOCATION WHITE SAN	LABOR COSTS	Average	Rate		27.60	27.60						
	ORTH BLVI				Manhours	Mandays (6)		0.09	0.85						
	JTH WADSW		BER	COST		Total (5)		26.28	84.36						
	ADDRESS 2750 SOU		PROJECT NUMBER	MATERIAL COST		G. Git		2.19	14.06						
NMO	-				Quantity	(3)		12	9						
E BREAKD		1845			o Crit	Measure (2)		EA	EA						
CONSTRUCTION COST ESTIMATE BREAKDOWN	EMC ENGINEERS INC.	CONTRACT FOR (Work to be performed) ENERGY EFFICIENT LIGHTING IN BLDG. 1845	PURCHASE REQUEST NUMBER		Item	(E)	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS	4 FT. ENERGY EFFICIENT LAMPS	ENERGY EFFICIENT BALLASTS						
	CONTRACTOR	CONTRACT FC	PURCHASE RE		Line	No.									

Energy savings realized with Maxi-Miser systems...

compared to standard systems can pay back the added initial investment in less than two years in most new installations.

Other operating costs, such as ballast replacement or air conditioning costs, may also be lower depending on the application.

MAXI-MISER SYSTEM	F40 .	F96SL	€ 2 % F96HO
FIXTURE TYPE	4 Lamp Troffer ≠ 10,000	2 Lamp Strip \$ 20,000	2 Lamp Industrial
ANNUAL OPERATING HOURS	4,000	6,000	4,500
Added Initial Cost*	\$566	\$2011	\$6572
Operating Cost Savings* Simple Payback Period	2.876 8 months	2827 9 months	4305 18 months
*Numbers shown are for illustration only based on a 4c/kwh energy rate. Values will vary depending on actual energy rate, equipment costs and application.			Standard Addition

MAXI-MISER SYSTEM PERFORMANCE VS. STANDARD SYSTEMS*

System	Relative Light Output	Input Watts	Watts Saved	Efficiency Lumen Output per Watt (LPW)	Efficiency Increase	Relative Cost-of-Light
F40 Rapid Start Standard Maxi-Miser	-100 104	88 74	16%	59 73	24%	1.00 .90
F96 Slimline Standard Maxi-Miser	100 100	172 136	21%	69 86	25%	1.00 .90
F96 High Output Standard Maxi-Miser	100 99.4	253 211	17%	70 84	19%	1.00 -4 .92

^{*}Data based on fixture tests conducted with center rated products in 77°F ambient, F40 – 4 lamp recessed troffer, slimline – 2 lamp strip, high output – 2 lamp industrial.

The Maxi-Miser System

	ranki kira	SPEC	IFICAT	IONS AI	ND DA	ΓΑ	the state	THE RESERVE OF THE PARTY OF THE PARTY.
LAMPWATT-MISER II	23.7		BALLAST.	MAXI-MISE	RII			
ORDERING CODE	CATALOG NUMBER	NUMBER OF LAMPS	LINE VOLTAGE	LINE CURRENTO	INPUT WATTS.	SOUND RATING	UNITS CASE	GENERAL DATA
F40LW/RS/WM	8G1028W 8G1078W 8G1038W 8G1088W	2 1 2 1	120 120 277 277	.65 .38 .29 .17	78 46 79 48	A A A A	20 20 20 20 20	UL Listed → - Yes Performance - ETL Certified† Protection - Bonus Line Class P Capacitor - Non PCB
F96T12LW/WM'	8G1008W 8G1018W	2 2	120 277	1.2 .51	136 135	C,C	6	Protected Power Factor ⊇above 90% Frequency – 60 Hertz
F96T12LW/HO/WM	8G1148W 8G1158W	2 2	120 277	1.73 5.75	212 213	В * В	6 6	Min:Start=60°F:Temp

- O With 35-Watt Lamps.
- Bulk packed. To obtain individual pack, add suffix F to catalog number. Individual Pack F40-10/Case.
- ★ Maxi-Miser II UL listed for use with standard or energy saving lamps. See label.
- ▲ Lamps and Ballast tested in 77°F. Data for fixture test will vary.
- † ETL Certification of performance to specifications in ETL. Procedure B20.2 with test methods per American National Standard C82.2.

Application Recommendation:

The Maxi-Miser II ballast is intended for use in lamp ambients of 60°F or higher

GUIDE SPECIFICATION-F40

Ballast shall be General Electric Maxi-Miser II or approved equal and shall be useable with F40 Lite White energy saving lamps as approved by the lamp manufacturer. Ballast performance with such lamps shall be certified by a nationally recognized independent testing laboratory with a United States government registered certification mark for fluorescent lamp ballasts. Performance certification shall be conducted per ETL procedure B20.2 in accordance with American National Standard C82.2 test methods.

 Ballast nameplate shall show certified input watts and relative light output with energy saving, high efficiency lamps. The relative light output shall be 95% with a tolerance

of +5 to $-2\frac{1}{2}$ %.

- Ballast case temperature shall not exceed 90°C.
- Ballast shall be equipped with UL component recognized non-PCB protected capacitors and a core and coil protector as in Bonus Line® dual protection.
- Ballast shall be high power factor, UL listed Class P.
- Ballast shall be warranted for three years.

PRODUCT CERTIFICATION

Many commercial and industrial lighting fixtures contain ballasts which are certified for use with specific lamps in a program sponsored by the Certified Ballast Manufacturers (CBM) Association. An independent organization, ETL Testing Laboratories, Inc., (ETL) is used by CBM to conduct certification tests to certain performance and safety standards. These standards are based upon lamp and ballast specifications established by ANSI.

In order to be CBM certified, one requirement is that the ballast deliver at least 92.5%

(95% on some lamps) of the light output delivered by a standard reference test reactor used to establish rated lamp requirements. This CBM certification program requires that there be approved ANSI standards for the specific lamps with which the ballasts are being certified.

As yet no ANSI standards exist for fluorescent energy saving lamps. Therefore, General Electric has proceeded to obtain an independent certification that the Maxi-Miser II ballasts with Watt-Miser II lamps provide the minimum relative light output

shown on the product label. In addition, separate tests conducted by General Electric show Maxi-Miser II relative light output is equal to or greater than standard lamps and ballasts when tested in most typical fixture installations.

The independent laboratory certification of the Maxi-Miser II ballasts is performed by ETL in accordance with ETL procedure B20.2 with test methods per ANSI C82.2. This separate certification program includes continuing unannounced audit of General Electric's Maxi-Miser II ballasts by ETL.

100 Years of Progress for People

D5-18

GENERAI 212-9124 8/79



Fluorescent Ballasts Jump Start Energy Efficiency

Energy-saving standard ballasts use higher-quality components than standard ballasts, limiting internal losses, lowering input watts and improving system efficiency.

By PAULA S. ANDREWS, P.E. Senior Lighting Designer Newcomb & Boyd, Atlanta

Energy efficiency in electrical systems has become increasingly important as concerns mount about costs environmental effects of wasting rgy. One area where this is particularly true is lighting. According to the Environmental Protection Agency (EPA), as much as 80% to 90% of electrical energy in the United States is spent on lighting.

Clearly, it makes sense both envi-

ronmentally and economically to maximize the performance of lighting systems. The lighting industry is addressing this issue with new products and the refinement of old standards.

At the center of these changes is the fluorescent lamp ballast.

Ballast function

A ballast creates the necessary circuit conditions (voltage, current, wave form) for starting and operating an electric-discharge (fluorescent or high-intensity) lamp. This article addresses fluorescent ballasts.

Fluorescent lamps are filled with a gaseous mixture that includes vaporized mercury. The lamps' inner surfaces are coated with a fluorescent powder. For a lamp to produce light, voltage is supplied to filaments, or cathodes, at each end.

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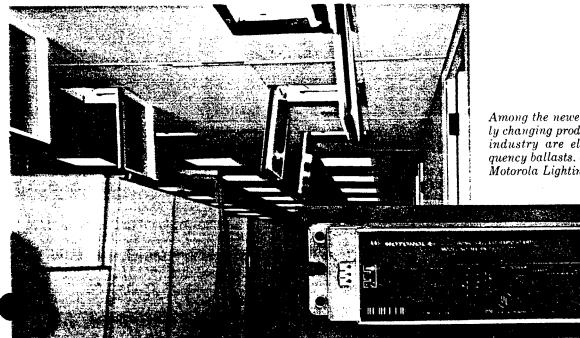
volt.

cath

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Once the cathodes are heated sufficiently, an arc strikes between them. The electrons and ionized gas inside the tube collide, causing emission of ultraviolet (UV) energy, which reacts with the powder coating and causes it to fluoresce. The UV energy is filtered out by the tube's glass wall,



Among the newest and most rapidly changing products in the lighting industry are electronic high-frequency ballasts. (Photos courtesy of Motorola Lighting, Inc.)

D5-19

CONSULTING-SPECIFYING ENGINEER

	TABLE 1	
COMPARING LAM	P AND BALLAST	COMBINATIONS

Ballast type	Electroms energy savii 34-watt The standar	ng F40T12 lamps	Electromagnetic F32T8 lamps	F40	brid)T12 It lamps	34-	Elec 0T12 watt nps	tronic F32T8	lamps
277 volt	2L/1L	3L	2L/1L	2L/1L	3L	2L/1L	3L	2L/1L	3L
Lamps per ballast	2/1	3	2/1	2/1	3	2/1	3	2/1	3
Ballast per fixture	1/1	1	1/1	1/1	1	1/1	1	1/1	1
ANSI input watts per fixture	113	108 (Note 1)	107	95 (Note 1)	88 (Note 2)	89	89	107 (Note 1)	92
Annual hours of operation (Note 3)	3,120								-
Annual kw hours of operation per fixture	353	337	334	296	275	278	278	334	287
Energy cost per kw hour	\$0.08						•		
Annual energy cost per fixture	\$28.24	\$26.96	\$26.72	\$23.68	\$22.00	\$22.24	\$22.24	\$26.72	\$22.96
Annual energy cost from standard		\$1.28	\$1.52	\$4.56	\$6.24	\$6.00	\$6.00	\$1.52	\$5.28
Ballast factor	0.92	0.94	0.95 (Note 1)	0.80	0.79	0.86	0.86	0.95	0.92
Lumens per watt (Note 5)	68	73	76	71	75	81	81	0.76	86

NOTES:

- 1) Two manufacturers only
- 2) One manufacturer only
- 3) 12 hours/day × 5 days/week × 52 weeks/year
 - = 3,120 hours/year

- 4) 12 hours/day \times 52 weeks/year = 3.120 hours/year
- 5) 2,800 lumens/lamp \times 3 lamps = 8,400 lumens (for F40T12 34-watt 3500K)
 - $2,850 \text{ lumens/lamp} \times 3 \text{ lamps} = 8,550 \text{ lumens (for F32T8 3500K)}$

but visible-spectrum wavelengths escape and light is emitted.

One function of the ballast, then, is to take line voltage (120 or 277 volts, alternating current) and supply the proper starting voltage to the cathodes. The ballast also limits current once the arc begins by introducing additional impedance in the circuit. Without added impedance, the lamp would probably not light; if it did, it would quickly self-destruct.

Because fluorescent lamps are particular about starting and operating conditions, and proper performance is dependent upon these electrical characteristics, the American National Standards Institute, Inc. (ANSI) has developed precise ballast performance specifications, ANSI C82.1, C82.2 and C82.3.

The Certified Ballast Manufacturers Association (CBMA) has developed a program that certifies whether a fluorescent ballast meets ANSI C82 series standards, as well as the ANSI 78 series standards for lamps. Certification tests are conducted by ETL Testing Laboratories, Inc., an independent testing agency.

Ballast types

There are three primary types of fluorescent lamp circuits: preheat, rapid start and instant start. Each lamp circuit type has its own ballast.

Preheat-Fluorescent-lamp cathodes must be heated before the arc can be established. This is done by a starter circuit separate from the ballast. The starter switch applies ballast

output voltage across the cathodes. When the cathodes are heated, the switch opens. This applies the voltage across the lamp, strikes the arc and initiates the gas discharge.

Rapid start—Rapid-start-lamp cathodes are heated prior to and during operation. The ballast has secondary windings that provide heating voltage across the electrodes. Hybrid ballasts remove this cathode heating circuit once the arc is established.

Instant start—The cathodes of instant-start lamps are preheated prior to applying ballast output voltage. Because the cathodes are unheated, in order to strike an arc, the ballasts must apply voltage to the cathodes that is much higher than that used for rapid-start lamps.

Rapid-start ballasts are the most

While reading guidelines and manufacturer's literature is important, the best teacher is field testing

Law Requires Minimum BEF

Public Law 100-357, also known as the "National Appliance Energy Conservation Amendments of 1988," stipulates a minimum ballast efficacy factor (BEF) for four common fluorescent lamp/ballast combinations (see Table 2). Ballast efficacy factor is defined as the "relative light output divided by the power input of a fluorescent lamp ballast."

The power input of the fluorescent lamp ballast is measured under ANSI C82.2-1984 test conditions. Relative light output is defined as "the light output delivered through the use of a ballast divided by the light output delivered through the use of a reference ballast" and is expressed as a percent. This also is called ballast factor.

Again, test procedures are specified in ANSI C82.2-1984. The standards indicate that ballasts: a) manufactured on or after April 1, 1990, or incorporated into a luminaire by a luminaire manufacturer on or after April 1, 1991; and b) designed to operate at 120 or 277 volts nominal with

an input-current frequency of 60 Hz, and in connection with F40T12, F96T12 or F96T120H0 lamps, must be in accordance with the specifications shown in Table 2.

In addition to BEFs, the law stipulates that these ballasts must have a power factor of 0.90 or greater. These standards do not apply, however, to dimming ballasts, ballasts for use in ambient temperatures of 0°F or less, or ballasts designed for residential applications with power factors of less than 0.90. The BEF provides a basis for ballast performance comparison for a specific ballast that eliminates variations in lamps from measurements.

Note, however, BEFs have no relationship to one another when different types or numbers of lamps are involved. Also, BEF information is not always readily available from ballast manufacturers except for the ballasts affected by Public Law 100-357. For this reason, BEF information is of limited use in evaluating efficiency opportunities.

prevalent electromagnetic ballast type. They offer a smoother start than preheat ballasts and generally provide longer lamp life than instant-start ballasts. Electronic ballasts for T8 lamps are often instant start, primarily because energy can be saved by not running a cathode heating circuit.

Lamp life is apparently also a question of hours per burn, especially for T8 lamps. Some lamp manufacturers derate lamp life as much as 5,000 hours for use with instant-start ballasts. But at least one major lamp manufacturer has published information indicating that as hours per burn increase from the standard three hours, lamp life of the F32T8 lamp on an instant-start ballast approaches and finally equals lamp life on a rapid-start ballast.

Energy-efficient ballasts

Both lamps and ballasts have been studied and changed since the oil crisis of the 1970s. A variety of energy-saving lamps are available. Yet without energy-saving ballasts, benefits are limited.

Energy-saving electromagnetic ballasts on the market today use higherquality components than standard electromagnetic ballasts, thus limiting internal losses, lowering input watts and improving system efficiency. These ballasts operate either standard or energy-saving lamps and, by law, have taken the place of standard ballasts for certain lamps (see "Law Requires Minimum BEF" sidebar).

Further efforts to decrease ballast input watts have produced hybrid ballasts. These devices are for rapid-start lamps, and have the same standard core and coil electromagnetic components as energy-saving ballasts. However, as mentioned previously, they have added electronic components that turn off the cathode heating circuit after the lamps have established the arc, thus saving energy.

Electronic ballasts

Among the newest and most rapidly changing products in the lighting industry are electronic high-frequency ballasts. As early as the 1950s, electronic ballasts were used for specialized needs, but efficien-

TABLE 2 MINIMUM BALLAST EFFICACY FACTOR (BEF)

Application for operation of	Ballast	Total	Ballast
	input	nominal	efficacy
	voltage	lamp watts	factor
One F40T12 lamp	120	40	1.805
	277	40	1.805
Two F40T12 lamps	120	80	1.060
	277	80	1.050
Two F96T12 lamps	120	150	0.570
	277	150	0.570
Two F96T120H0 lamps	120	220	0.390
	277	220	0.390

To make an informed decision about the best lamp and ballast combination, look at system efficiency and long-term performance

cies were only about 60%, and the ballasts required large heat sinks. It was shown, however, that running fluorescent lamps at high frequencies could improve efficiency,

so research continued.

About 10 years ago technology was developed to operate lamps at more than 3,000 Hertz (Hz) through the use of semiconductors. Further research provided circuitry to operate lamps at 20,000 to 30,000 Hz. This technology is being used currently.

Electronic ballasts consist of four basic components: input circuitry, power switch, output circuitry and controller. The input circuit is a rectifier, which converts line voltage alternating current (ac) into direct current (dc). The power switch is an inverter that converts dc into high-frequency ac.

The output circuit uses the highfrequency ac to start the lamp, and. the control circuit provides powerfactor correction and may incorporate a mechanism for controlling light

output.

With an electromagnetic ballast, voltage and current to the lamp cycle 60 times a second. During the course of each cycle, the arc is nearly extinguished 120 times a second, and part of the operating current of the lamp is used to re-energize the phosphors. When current to the lamp is cycling 20,000 times per second or more, the phosphors do not have time to deenergize, so less current is needed to produce an equal amount of light.

Electronic standards

ANSI is in the process of developing a standard for electronic ballasts. A number of manufacturers have established track records for low failure rates and good service. In addition many new companies, or new divisions of old companies, have start-

Until a broad base of empirical data is developed, consider and weigh as many factors and variables as possible

ed making electronic ballasts. Time alone will tell how they will fare, but in the meantime, a specifier must educate himself and his client about the risks and benefits of using this relatively new technology.

A good source of general information about electronic ballasts is the California Energy Commission's "Advanced Lighting Technologies Applications Guidelines." Published in March 1990, the section titled "Energy Efficient and Electronic Ballasts" provides application and specification guidelines (see "Elec-tronic Power Community..." sidebar). Ballast manufacturers' technical literature also provides helpful information.

Field testing

The best teacher, however, is field testing. Obviously, not everyone is set up to install test groups of different ballasts and run them in controlled settings to obtain empirical test data. However, if a client has existing facilities and is interested in finding the best system(s), this type of testing should be considered.

If this type of testing is not possible, a company should develop a data base on its projects that use electronic ballasts. Record exactly what systems are installed, including ballast catalog numbers. Note delivery and installation problems (or lack thereof), and keep records of the number of ballast failures in the first six months to three years for each project. There is no substitute for first-hand experience.

Comparing information

In planning a lighting system, it is important to look at more than just watts saved per fixture, especially in new construction. To make an in-

California Energy Commission Sets Forth Ballast Guidelines

The following specifications for electronic ballasts are reprinted, with permission, from the "Advanced Lighting Guidelines" of the California Energy Commission.

2.n. Electronic Ballasts

- · UL Listed Class P Sound rated A
- · No PCBs
- Solid-state electronic ballast consisting of rectifier, high-frequency inverter, and power control and regulation circuitry

· Enclosure size and wiring same

as magnetic ballast

· Ballast factor of (see chart or manufacturer's literature) or as required

· Light regulation plus or minus

10% with plus or minus 10% input voltage variation

High power factor, minimum 90%

 Lamp current crest factor less than or equal to 1.7

 Input current third harmonic not exceeding ANSI recommendation; 32% total harmonic distortion, 27.5% of the third triplens (see manufacturer's literature)

 Flicker 15% or less with any lamp suitable for the ballast

 Lamps shall be operated in (instant start) (rapid start) (rapid start, stepped output) (rapid start, continuously adjustable output) mode

 Design to withstand line transients per IEEE 587, category A

- · Ballast case temperature shall not exceed 25°C rise over 40°C ambient
- · Shall meet FCC rules and regulations, Part 18

 Describe connection and circuit for adjustable of stepped ballasts

 Three year warranty including \$10 labor allowance

Special Note: Specifiers should investigate the marketplace and compare the product offerings closely to the information contained in this guideline. New product developments may make some portions of this report incomplete.

To order Publication 400-90-014, contact the California Energy Commission at 916/654-5200.

Efforts to decrease input watts have produced hybrid ballasts

Electronic Power Community Concerned With Harmonics

Magnetic and electronic fluorescent ballasts, like computers and motor-speed controls, generate line-current harmonics. With the growing use of these technologies, the electrical power community, including public utilities, are concerned. There are two po-

tential problems.

In three-phase balanced distribution systems, the load can become unbalanced, causing the neutrals to carry additional current and, in some cases, to become overloaded. It also is possible for the harmonics to cause voltage distortion of the supply voltage, which could adversely effect the operation of other electrically sensitive equipment.

In wiring designs where the lighting circuits are isolated by floor from other circuits, these harmonic currents can be controlled and not be allowed to affect the sinusoidal shape of the

input voltage.

The range of harmonic currents generated by electronic ballasts can vary from well below 10% to much more than 100% of the fundamental current. In fact, several generate less harmonic current than magnetic ballasts. The majority of producers are holding harmonics to under the proposed ANSI recommended standard of 32% total harmonic distortion and 27.5% of the third triplens (those currents that add upon the three phase neutral). These currents are then easily held to within the IEEE 519 draft standard on voltage distortion for various size building loads.

However, further studies on power quality are in progress, which may alter the harmonic distortion standards. If more stringent measures are necessary, the electronic-ballast industry is prepared to employ additional means to meet the requirements.

Reprinted, with permission, from the California Energy Commission.

formed decision about the lamp and ballast combination that suits a client's needs, consider system efficiency and long-term performance. Table 1 compares several options in fluorescent lamp and ballast combinations. The comparison is based on using a three-lamp fluorescent fixture.

The first column shows information on "the standard," using 34-watt F40T12 lamps and two standard, electromagnetic, energy-saving ballasts in a two-lamp/one-lamp combination. This is a system typically used in today's offices. The columns that follow provide information on other combinations: 34-watt lamps with a threelamp ballast; an energy-saving, threelamp ballast with F32T8 lamps; hybrid ballasts for 34-watt F40T12 lamps in both two-lamp/one-lamp and three-lamp combinations; and 34-watt F40T12 lamps and F32T8 lamps with two-lamp/one-lamp and three-lamp electronic ballasts.

The input wattages shown are, for the most part, averages of published ANSI wattages from three ballast manufacturers. In some cases, a product was available only from one or two of the companies listed; these cases are indicated. Note, in some cases, the manufacturers' published ANSI input wattages deviate by as much as six watts from the averages shown. For ballast factor, some of the published values deviate by as much as 0.04 from the averages shown.

Annual operation hours are based on running fixtures 12 hours per day, five days a week, 52 weeks a year, for a total of 3,120 hours. Energy cost was chosen arbitrarily at \$0.08 per kilowatt-hour. Annual energy cost per fixture is the product of input watts, annual operation hours and energy cost. The next row shows the difference in annual energy cost per fixture from the standard. This row is revealing, and if this were the only information given, three-lamp hybrid ballasts would probably be chosen.

However, the next row shows why this may not be the best decision. Ballast factor, also known as relative light output, is the ratio of light output delivered by a ballast to light output delivered by a reference ballast. Note the ballast factor for the three-lamp hybrid ballast is 79%, the lowest of all ballasts compared.

A one-to-one replacement of the

standard with this ballast could lower the light level in an existing space significantly, assuming existing fixtures were reasonably clean and had relatively new lamps before the replacement.

Using the three-lamp hybrid ballast in new construction could require 15% more light fixtures to provide the same light output as the standard. Therefore, while \$6.24 per fixture in energy costs is saved, light is lost, and worker performance may decrease. Alternatively, additional fixtures may be required, adding cost.

Perhaps the best way to compare fluorescent lamp and ballast combinations is to look at lumens per watt, shown in the last row. In this comparison, the three-lamp electronic ballast with F32T8 lamps does best, at

86 lumens per watt.

The information presented in Table 1 should be used only as a starting point for comparisons. It is important to realize that while ANSI bench test input watts were used for this comparison, input watts for ballasts in fixtures will vary from these values. How much depends on whether the fixture is open or enclosed and the size and location of the ballast compartment, among other variables.

The ANSI input watt values and the ballast factors from up to three manufacturers also were averaged. Compare data from these manufacturers, yet consider other manufacturers

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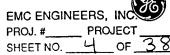
When evaluating ballast and lamp combinations, every project and application is unique. Until a broad base of empirical data is developed, or until the market settles down and offers more standardized products, consider and weigh as many factors and variables as possible. This will ensure the systems you design meet clients' needs for energy conservation and optimum performance over the long term.

Reprints of Consulting-Specifying Engineer's articles are available in quantities of 500 or more. For information, contact Reprint Services Department, Cahners Plaza, 1350 E. Touhy Ave., P.O. Box 5080, Des Plaines, Ill. 60017-5080. Phone: 708/635-8800.

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	Bldge	Existing Fixture Ty		Dalls/Fixture	Proposed Lixture Type L	Solls/Exture
 	1743	4'2-Tube Fluoros	67	96	Replace ballost + lamps	71
		4'4-Tube Fluoros.	3	181	Replace ballast + lamps	140
_		8'2-Tube Fluoros	57	ברו	Replace ballast	135
		462	18	160		
-	1751	4'2-Tube Floores.	187	96	Replace ballost +lamps	71
રાન્લમાંશકાના		4'4-Tube fluoros	lo	181	Replace ballost	140
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	228′——
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55 fixtu	res x 124w = 6,820 W 6,820 W=120Y = 56.83 Amps
	(16 Amps/breaker I need 4 circuits)
fixtures alomas (150	Metal halide - 250 W prices)
<u>Mat</u> LAD 260.00 72.	30R 04P TOTAL 00 63.00 400.00
	,
tixtures a temps (5	z 131.80 (+)
4 circuits Domolition	× 1,185,90
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6300 lumens/fixtu	Re











E-231/2

E-17

ANSI Code Case Ref. Case Case HID footnotes Code Case Case Case Case Case Case Case Cas	Design Factor (210)	ctor	
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HALARC" LAMPS

This family of high-performance metal halide lamps features higher lumens-per-watt and lumen maintenance, more consistant color, warmer, incandescent-like appearance — and generally provides lower cost-of-light - than other metal halide or mercury lamps of equal wattage. However, a momentary shift of pastel pink color may infrequently occur as this lamp stabilizes during operation.

32 WATTS - HALARC LAMP

(Open and Enclosed Fixtures - Base Up $\pm 15^{\circ}$ Burning only. Use With GE Approved Ballast

BASE: MEDIUM(NPBB)

E-17 66 16469	MXR32/C/VBU	M100GZ-32/VBU	6	Coared Wert 2515 25 576 27/15 10000 2500 2500 1000 1000

100 WATTS - HALARC' LAMPS

ENCLOSED FIXTURES ONLY - VERTICAL $\pm\,15^{\circ}$ BURNING ONLY. Use Metal Halide ballast

(ANSI spec. "M90") BASE: MEDIUM (NPBB)

D7 (O L1 111LD 11	(
B-17冬秋 > 18680	MXR100/BU/BD	M90TW-100/BU-BD	6	Car
B-17 > 18680	MXR100/C/BU/BD	M90TX-100/BU-BD	6	Canaca Variation 18 5/28 3 40 4000 88 5000 88 6 00 88 1/1 88

175 WATTS - HALARC' LAMPS ENCLOSED FIXTURES ONLY - VERTICAL \pm 15° BURNING ONLY. Use Metal Halide ballast (ANSI spec. "M57")

WARNING:DO NOT USE IN EXPLOSION PROOF OR HAZARDOUS DUTY FIXTURES BECAUSE HALARC LAMPS HAVE HIGHER BULB TEMPERATURES THAN STANDARD 175-WATT METAL HALIDE LAMPS AND MAY EXCEED THE TEMPERATURE RATING OF THESE FIXTURE TYPES.

BASE: MOGUL (NPBB)

Concessed !		MXR175/BU	M57PE-175/XBU	6	CAR V V
E-2372	11417	MAR1/5/50	MIGTE-175/ADG	"	20 Cary 1865 7 20 Kits 1966 1968 1868 1868 1868 1868 1868 1868
	11203	MXR175/C/BU	M67PF-175/XBU	6	Consider Venter 5 77 5 5 1 50000 10750 12/50 12/50 12/50
	11420	MXR175/BD	M57PE-175/XBD	6	CONTROL 04% 15 10000 10000 (6000 040)
	11418	MXR175/C/BD	M57PF-175/XBD	6	Condd Ventral 27, 770 578 (10000 15750 12750 0570 0570 15750 17750

STANDARD-LINE MULTI-VAPOR* LAMPS

175 WATTS - MULTI-VAPOR - ENCLOSED FIXTURES ONLY. Use Metal Halide Ballast

(ANSI spec. "M57")

BASE: MOGUL

E-28	47760	MVR175/U	M57PE-175/U	12	Clear (260) \$8.6 5 \$ 10000\\$ 14000\\$ 10350\\$ 0.70 \$8.6 \$ 6000\\$ 12000\\$ 8300\\$ 5000\\$
*	47761	MVR175/C/U	M57PF-175/U	12	Coated (260) \$2532 8 5 5 3 10000V 44000V2 9950V2 0.70 8 2500 8 10000V2 7800H2 2500H2 2500H2 7800H2 2500 8 2500 8 1000 8 1
2.0	17634	MVR175/SP30/U	M57PF-175/SP30	12	Coared (260) 8 W 5 3 30000V 12000V 8300V 0.85 8 6000H 10300H 7,100H 7

New Product Listing.

Nation Addition

See page 73 for definition of "Rated Life".









MULTI-VAPOR METAL HALIDE LAMPS

EMC ENGINEERS, INC. PROJ. # PROJECT

SHEET NO. 5 OF 38

Bulb (249)	Ordering Code	Description	ANSI Cede Ref. Only	Case Oty	Additional Information See HID footnotes Page 84	MOL in.	LCL In.	Rated Avg. Life Hours (°)	Reference Lumens (Any Burn Pos.) Int. Mean (244) (205)	Design Factor (210)
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250 WATTS - MULTI-VAPOR LAMPS - ENCLOSED FIXTURES ONLY. Use Metal Halide Ballast (ANSI spec. "M58")

BASE: MOGUL

E-28	42729	MVR250/U	M58PG-250/U	12	Geer 9 84 5 10000 20500V 17000V 0.80 3 10000 19500H 17000V 0.80 3 10000 19500H 17000V
	42731	MVR250/C/U	M58PH-250/U	12	Costed (1577) 5 84 5 170000 20500V 16000V 0.80 7
	17633	MVR250/SP30/U	M58PH-250/SP30	12	Costed 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8

400 WATTS - MULTI-VAPOR LAMPS - In burning positions other than vertical base-up or base-down ±15°, use in enclosed fixtures only. Use Metal Halide ballast (ANSI spec. "M59")
BASE: MOGUL

3) !	43828	MVR400/U	M59PJ-400/U	6	Clerx (259) 7 20000 36000 28000 751 7 20000 32000 23700 3270000 327000 32700 32700 32700 32700 32700 32700 32700 32700 32700 3
	43829	MVR400/C/U	M59PK-400/U	6	Conted 259) 7.0 200007 360007 277007 0775 150001 3200018 2270019 2270019
	17632	MVR400/SP30/U	M59PK-400/SP30	6	Coated (259) 4 74 110 7 20000/4 33000/ 25000/1 0.80 3 50000 3 10000 25000/1 5500/1

1000 WATTS - MULTI-VAPOR LAMPS- In burning positions other than vertical base-up or base-down \pm 15°, use in enclosed fixtures only. Use Metal Halide ballast (ANSI spec. "M47")** BASE: MOGUL

B) 56 418	26 MVR1000/U	M47PA-1000/U	6	Clea 4 15 77 5 77 5 12000V 110000V 18000V 0.80 1007800H 86240H 18 12000V
B 356 418	27 MVR1000/C/U	M47PB-1000/U	6	Coared 9 55/73 9/4 12000V3 105000V 79800V8 0.80 10000H 76000H 76000H 76000H

HIGH-OUTPUT LINE MULTI-VAPOR' LAMPS

400 and 1000-watt lamps providing higher light output than the Standard Line Multi-Vapor lamps, for use where lamp operating position is near-vertical. Also, 1500-watt lamps providing very high light output for sports floodlighting or other uses where their shorter average life is acceptable.

175 WATTS - HIGH OUTPUT LINE - HORIZONTAL ±15° BURNING ONLY. Use Metal Halide Ballast (ANSI spec. "M57") Use in Position Oriented Mogul Sockets.

BASE: MOGUL (NPBB)

E-28 > 18104 MVR175/HOR —	12	Clear. HORIZ. ± 15° 8967 5 99 10000 15000 12000 NA
> 18105 MVR175/C/HOR —	12	Coated HORIZ 注 15 本海 8%

250 WATTS - HIGH OUTPUT LINE - HORIZONTAL \pm 15° BURNING ONLY. Use Metal halide ballast (ANSI spec. "M58") Use in Position Oriented Mogul Sockets. BASE: MOGUL (NPBB)

E-28 > 18101	MVR250/HOR	_	12	Clear—HORIZ ± 15° 844	5	10000 23 2300	00 👙 18000 🚱	- 20
> 18103	MVR250/C/HOR		12	Coated HORIZ. 土 15 经 8 英語	5 5 36	10000 🐼 2300	00 🦮 17000 😤	

> New Product Listing.

* See page 73 for definition of "Rated Life"

^{**} Can also be used on mercury lag or reactor type ballast with 440-volt minimum open-circuit voltage. This will provide reliable starting above 0°F. Lamps will typically operate at 970 watts. 109,200 lumens and 87,350 mean lumens.

PROJ. #_____ PROJECT

PROJ. #_____PROJECT_ SHEET NO. _____OF_38

RAPID START BALLASTS

Including Performance[™], Optimiser, Maxi-Miser[™] II, and Watt-Miser[™] Ballasts For 25-, 28-, 30-, 34-, and 40-Watt Rapid Start Lamps 60 Hertz

Lamp Descri	ption	Input Circuit	Ballast	Catalog ①	Certi-	Min. Start	Line@	② Input	Sound	Wiring Dia-		mensio		Ballast
Number and Type	Nom. Watts	Volt- age	Description	Number	fica- tion	Temp.	ent Amps		Rating	gram Fig. No.				Circuit Type
ovi≅ewia	·9\(/	ωW∃:	i z (Groin											
I) F30T12	30	120	Standard	8G1075③		50	0.63	36	Α	13	61/2	13/8	115/16	Lag
i) F40T12	40	120 120	Standard Dimming	8G1075③ 8G3670	=	50 50	0.60 0.53	36 40	A	13 15	6½ 6½	13/s 13/s	115/16 115/16	Lag Lag
he exter	हिस्स	NE:	7.1800:		onelle.					e Mari				
I) FM28⊕	28	120 277	Optimiser Optimiser	M28-120-1F M28-277-1F	EIL	60 60	0.39 0.17	37 38	A	42 42	9½ 9½	1½ 1½	2% 2%	Lead Lead
i) F30T12/RS	30	120 120 240 277 277	Standard Low Temp. Standard Standard Low Temp.	8G1071W 8G3688W 8G3930WF 8G1072W 8G3689W	CBM CBM	50 0 50 50	0.40 0.45 0.18 0.17 0.20	46 54 42 46 54	A A B A	22 22 12 22 22	9½ 9½ 9½ 9½ 9½ 9½	1½ 1½ 1½ 1½ 1½ 1½	2% 2% 2% 2% 2% 2% 2%	Lead Lead Lead Lead Lead
i) F40T12/RS nergy Saving	34	120 277 120 277	Maxi-Miser II Maxi-Miser II Optimiser Optimiser	8G1078W® 8G1088W® M28-120-IF M28-277-IF	료를 I I	60 60 60 60	0.38 0.17 0.32 0.15	45 47 37 38	A A A	42 42 42 42	9½ 9½ 9½ 9½	1½ 1½ 1½ 1½ 1½	2% 2% 2% 2% 2%	Lead Lead Lead Lead
) F40T12/RS	40	120 120 120 120 120 120 240 277 277 277 277 277	Standard Watt-Miser II Low Temp. Optimiser Standard Standard Watt-Miser II Low Temp. Optimiser Optimiser Optimiser Optimiser Optimiser Optimiser Optimiser	8G1063W ⁽³⁾ 8G1074W ⁽³⁾ 8G1078W ⁽³⁾ 8G3688W 8G5001WF M28-120-1F 8G3930W 8G1068W ⁽³⁾ 8G1088W ⁽³⁾ 8G1088W ⁽³⁾ 8G3689W M28-277-1F	CBM CBM CBM CBM CBM	5555°55555°5	0.48, 0.40, 0.44, 0.45, 0.43, 0.39, 0.20, 0.18, 0.19, 0.20, 0.17	552 54 50 45 ∞50 ₹ 55	AAAAABAAAA	444 442 1542 1444 442 44 44 44 44 44 44 44 44 44 44 44	9½ 9½ 9½ 9½ 9½ 9½ 9½ 9½ 9½ 9½	1½ 1½ 1½ 1½ 1½ 1¼ 1¼ 1½ 1½ 1½ 1½ 1½ 1½ 1½	2% 2% 2% 2% 2% 2% 2% 2% 2% 2% 2% 2% 2%	Lead Lead Lead Lead Lead Lead Lead Lead
Wei-Living	विभिन्न	可信	14.40211		. M-14				7. A.			7.47		
2) F30T12/RS nergy Saving	25	120 277	Optimiser Optimiser	M28-120 M28-277	ETL	60 60	0.41 0.18	60 61	A	14	91/2	1½	2%	Series Le
2) FM28	28	120 277	Optimiser Optimiser	M28-120 M28-277	ETL	60 60	0.53 0.23	60 60	A A	14 14	9½ 9½	1½ 1½	23/8 23/8	Series Le Series Le
2) F30T12/RS	30	120 120 277 277	Standard Low Temp Standard Low Temp	8G3971W 8G3905W 8G3972W 8G3907W	CBM CBM	50 0 50	0.67 0.63 0.29 0.28	78 74 78 76	A A A	14 14 14 14	9½ 9½ 9½ 9½ 9½	1½ 1½ 1½ 1½ 11/16	2% 2% 2% 2% 2%	Series Le Series Le Series Le Series Le
2) F40T12/RS nergy Saving	34	120 120 277 120 277	Maxi-Miser II Maxi-Miser II Kit Maxi-Miser II Optimiser Optimiser	8G1028W® 8G1028W10® 8G1038W® M28-120 M28-120		60 60 60 60	0.64 0.64 0.28 0.52 0.22	76 76 77 59 60	A A A A	14 14 14 14 14	9½ 9½ 9½ 9½ 9½ 9½	11/2 11/2 11/2 11/2 11/2	23/8 23/8 23/8 23/8 23/8	Series Le Series Le Series Le Series Le Series Le
2) FE40/WM	34	120 277	Performance Performance	E40-120-2 E40-277-2	11	60 60	0.54 0.22	62 62	A A	14 14	9½ 9½	1½ 1½	23/8 23/8	Series Le Series Le
2) FE40/MM	40	120 277	Performance Performance	E40-120-2 E40-277-2	_	50 50	0.65 0.26	74 74	A	14 14	9½ 9½	11/2	23/8 23/8	Series Le Series Le

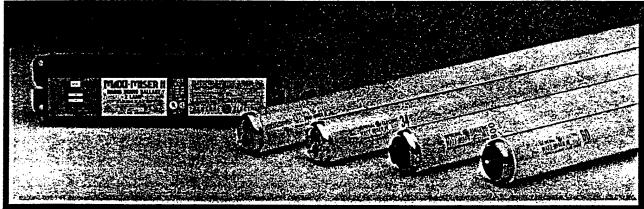
① High-power-factor ballasts are suitable but not CBM certified for use with energy-saving lamps. Minimum temperature for energy-saving lamps is 60°F. Energy-saving lamps are not suitable with dimming and 30-watt single-lamp Rapid Start ballasts.

③ CSA approved.

អាជាការអាជាក

② Input watts per tests to ANSI C82.2. Watts measured in installed fixtures will be lower and vary by application.





GE technology has created a family of low-loss, energysaving fluorescent ballasts designed to operate today's high efficiency lamps at peak light output. More light, in fact, than other ballasts commercially available today. ស្តីខ្មែរ 🖟 ខ្មុសនៃ ២៤៤ 🦠 🔾

Available in 4' rapid start to operate Maxi-Miser or Watt-. Miser lamps and in 8' to operate Slimline or High Output Watt-Misers, these Maxi-Miser II systems offer you an effective way to lower your fluorescent cost of light. ్ల కేష్ చేసింది. మీ కేహ్స్ క్రామ్

Maxi-Miser II. Ballasts to gettern require

- Compatible with straight tube standard or 34-, 35-, 60-, or 90-watt energy-saving lamps.
- Cooler operation extends ballast life.
- Dimensionally interchangeable with standard ballasts.
- Light output and input watts ETL-Certified. in in a second of the second
- UL-Listed, Class P.
- Available for 4' rapid start, 8' instant start, and 8' high output lamp applications. a arreste papitu

For New Fixtures

(લેઇલઇલેઇસિવિલઇ)

Combine the Maxi-Miser II F40 ballast with GE's F40 Maxi-Miser II lamp and maintained light output will be 20% more than standard systems in typical 4-lamp fixtures. Used in an enclosed three-lamp troffer, this Maxi-Miser II system produces 95% of the maintained light of a standard four-lamp fixture.

For Replacement

If you want the most light and good energy savings, Maxi-Miser II Systems are easily installed in existing fixtures. For example, 8' Slimline Maxi-Miser II ballast and Watt-Miser II lamps reduce watts 21%, with no loss of light compared to a standard F96T12 system.

Cost of Light Comparison*: Maxi-Miser II Lamps & Ballasts

#284789 5069 5. To

Design Criteria 100 FC Maintained 10,000 Square Feet 3,000 Hours/Year 8 [¢] /KWH Energy Rate 2 X 4 Troffers	4 Standard Lamps On Standard Ballasts	4 Maxi-Miser II Lamps On Maxi-Miser II Ballasts	3 Maxi-Miser II Lamps On Maxi-Miser II Ballasts**
Number of Fixtures	206	171	216
Relative Costs			
Initial	100%	89%	100%
Operating	100%	84%	80%
Total Annual Owning and Operating Cost	100%	84%	85%

For basic lamp and ballast data, and cost assumptions used in this comparison, see the 1984 edition of General Lighting Cost Analysis, publicaiton #205-41211. A copy can be obtained by contacting your GÉ Lamp & Ballast sales representative.

^{** 2-}Lamp Ballasts, Tandem-Wired.

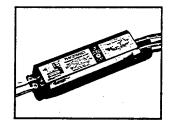
PROJ. # FLUORESCENT BALLAST DESCRIPTIONS

PROJECT



Optimiser

Innovative hybrid energy-saving ballast. Combines long-life solid-state switch with proven electromagnetic components. Use with 28-watt lamps to replace standard F40 systems and reduce lighting energy 34%. See page 5.



Performance™

Electronic high frequency ballast operates at very high effi-ciency. Contains advance state-of-the-art circuitry for maximum reliability and efficiency. Available in four models for 120- or 277-volt systems and two- or three-lamp designs. See page 4.



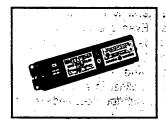
Maxi-Miser™ II

Full light output energy-saving ballast designed to improve lighting system performance. Maximum benefits when used with Maxi-Miser II or Watt-Miser II lamps. See page 6.



Low Temperature

Standard performance ballasts capable of starting at 0 or —20 F. Suitable for indoor use or mounting in enclosed fixtures. Not weatherproof.



distribute.

· Watt-Miser™

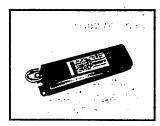
Economical energy-saving ballast. Uses less watts than standard ballasts. Compatible with standard or energy-saving lamps. See page 7. tal eligible in the Silver

and Selection of the control of



Plastic Sign

Ballast suitable for use in outdoor plastic signs. UL type II. Designed to meet lamp specifications for low-temperature starting. White case. Not wea-



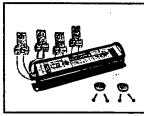
Standard

Standard performance ballasts rated 50°F minimum starting temperature. High power factor. Encased. أسحاد أناب



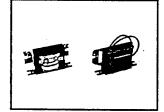
Circline

Encased Circline preheat ballasts are supplied with factorywired four pin lampholder.



Quick Change Kits

Two-lamp F40 rapid-start ballasts with factory-wired lam-pholders. Designed to replace preheat or standard rapid-start ballasts in existing fixtures.



Clamp-Core

Small core-and-coil ballast. Models with leads have metal case over the coil. Appliance models have quick connect terminals. Includes ballasts for Mod-U-Line® Twin Tube lamps.



Low Power Factor

Open or encased ballasts without capacitors. Ballasts are usually smaller in size, but use more current than comparable high power factor ballasts.



Consumer Pack

Popular ballasts used by DIY customers. Special packaging includes hook hang carton, wire nuts and installation instructions.

	EMC ENGINEERS, INC. PROJ. # PROJECT SHEET NO OF 38
Bldg, 1790 ·400 W Mercury Yapor	
250w Mercury Vapor -85 Currently 12,100 Int. lumens each - Replace 150w HPS lamps & fixtures	at = 15.600 lumens
200w Incomp13 currently - ≈ 37/0 App. lumens each	
Replace both WI50W HPS lamps efixtures lumens ea. for total lumen	s at 2 15600
Current wattage = 21,250 Proposed wattage + 2,000 Savings of 9	9
1,029,000 Lumas = 66 Fix TURES 15,600 lumas APS fixture	
Bedutui in waltry = 23,850 - 9,900 = 1	14,050 = 14 KW
#Savings = 14 KWx 2200 hr *\$ 0.0221 +1	14 KWX19.50 X2ms

	26 - 200W incardescent lamps @ 3700 lumens each = 96,200 lumens total									
 - -		ace with	0-175 W each =) Metal Ha		es © 20,000	(75 W) Domens			
- - -	lights x 16	High			,		<u>२००</u>) पप २			
		Materials 20.00	17.00 77.00	0aP 63.00	Total 400.00	39'				
	tixtueoso	-lamps (12 e	ach)							
individual in the second		3100.00	<i>974'0</i> 0	756,00	4,800.00					
; -	•	Branch Circu SW fixture	_	1 (Wh 1						
		12 fixtures		0104 W						
-		(IL A/Circuit		42	1 C = VOC/ +	.`7Amps				
	BrecCost	Ciecuit#1 +180 FT. 180.95	1839 - 1839	1 FT. 1 FT. 1 S						
	X-lea Ft.	597.LO 780,55	<u>511.</u>	58	474,78					
	Demolition	10.05/F	ature @	OL FIXTU	res = 126	1.30 \$1501	00			
						- 600k	2.00			

		EMC ENGINEERS, INC.
	•	PROJ. #PROJECT
	Bldg. 1753	
	Current energy use - 26,200 U Incand S Proposed " " - 12,175W Motal ha (\$247Wea)	fixtures = 5,200 W lides = ≈ 0,604
	(*27/Wea)	J'2dr M
•1		
นักเล่าสาราช		

	PROJ. # PROJECT	
•	Bldg, 1790 Replace 84, 400-Watt Mercury Vapor lamps with 325-Watt, Metal Halide lamps	S
	Materials Labor 040 Jotal each 71.70 9.31 17.01 98.00	<u>-</u>
	total \$6022.80 782.04 1428.84 8,233.68	
	Current energy use = 84 × 410 = 38,640 wates Proposed " " = 84 × 406.05 = 34,105 "	
	4,515 wolls savin	eps

EMC ENGINEERS, INC.

Bilding 1794	<u> </u> =_
--------------	----------------

	Materials Mat Labor OUP Jotal
 	260,00 77,00 63,00 400,00
-	total materials (48 each)
 	15,480 3,696 3,024 9,200
	Ciecuits 290 w/fixture x 48 fixtures = 13,920 W 13,920 + 1204 = 116 Amps (16 Amps/circuit = 8 circuits)
: - -	(16 Amps/circuit = 8 circuits)
asaasaaaaa	8 Circuits (each +151 feet of wiring) Bose cost = 18995 + (#330 x 151 FT) = \$684.97 /each
-	
	Domolition # 10.05/Fixture @ 96 fixtures = #964.80
	Total = \$25,63896
·	

	EMC ENGINEERS, INC. PROJ. # PROJECT
	PROJ. # PROJECT
	Bldg. 1794 - Replace 48 Mercury Vapor lamps and 48,0006 -thoundescent lamps with Metal Halide Lamps attichors
	mercury vapor = 43 lumens/watt = 17,200 lumens/lamp = 17,200 × 48 = 825,600 lumens
	200 W Incord ≈ 3700 lumens/lamp = = 3,700 × 48 = 177,600 lumens
	1,003,200 bmens Lota
<u> </u>	250 Watt Metal halides = ≈ 80 lumens/watt = 20,000 lumens/lamp = 20,000 × (1,003,200 + 20,000 = 50 lamps)
! 	
	lamps = 16 High
-	1/1/1/1/60
	Eherqy Savings:
	Current energy use = 400 w Morcury Vapor = 460 walls/each
	48-200 WIncard = 2 200 watts/lamp = 9,100 Watts
	9,600
	31,680 walls curpont
	Deawon 48, 250-W Model Halides = (290/fixture) = 290×48=13,900 Watts
	= 17,760 Watt savings
_	

REMOVAL OF 57 EXISTING INCANDESCENT FIXTURES IN BLDG. 236 REPLACE WITH 12, 250 WATT METAL HALIDE FIXTURES AND LAMPS

PRICES PER MEANS 1992 ELECTRICAL COST DATA AND RICHARDSON PROCESS PLANT CONSTRUCTION ESTIMATING STANDARDS

WILL REQUIRE:

3 CIRCUITS - NEW CONDUIT & WIRING FIXTURES (W/BALLAST) AND LAMPS DEMOLITION OF EXISTING EQUIPMENT

FIXTURES & LAMPS (EACH):

O&P

MATERIAL

LABOR

18.7%

TOTAL

\$260.00

\$77.00

\$63.00

\$400.00

FIXTURES & LAMPS (12 EACH):

\$3,120.00

\$924.00

\$756.00

\$4,800.00

LIGHTING BRANCH CIRCUITS:

BASE COST EQUALS BRANCH CIRCUIT MATERIALS AND LABOR TO 20 FEET ABOVE FLOOR FOR EACH ADDITIONAL FOOT OF CONDUIT RUN, \$3.32 WAS ADDED

CIRCUIT #1 CIRCUIT #2 CIRCUIT #3

+120 FT.

+162 FT.

+200 FT.

TOTAL

BASE COST:

Rightspielie

\$182.95

\$581.35

\$182.95

\$720.79

\$182.95

\$398.40 \$537.84

7

\$664.00 \$846.95

\$2,149.09

DEMOLITION:

\$10.05/FIXTURE @ 57 FIXTURES

\$572.85

\$7,521.94

Energy Savings = Current energy use = 11,400 WARS

Proposed " = 3,480".

7920

SHEET NO. 17 OF

PAGE 1

PAGE 1

BRANCH CIRCUITS FOR LIGHTING - RAPID E

UITS FOR

THIS ACCOUNT PRESENTS THE RICHARDSON ! LIGHTING INSTALLED. WORK PERFORMED B'

LIGHTING BRANCH CIRCUIT

A. Standard Installation. Costs shown are based on installations inside a single story building in a non-hazardous area, not over 12'-0" above floor.

	Material		Labor Cost	
Description	Cost	Manhours	@ \$25.00/Hour	Total Material & Labor
20 LF 1/2" Galvanized	\$20.11	(0.8)		į
Rigid Conduit	\$20.11	(0.0)		
2 Ea. 1/2" Galvanized Elbow			ì	
W/One Coupling Each	9.00	(0.7)	i	
65 LF #12 THW Copper Wire	5.32	(0.3)		
2 Ea. 1/2" Pipe Straps	0.20	(0.1)		
1 Ea. 4" Sq. Outlet Box			1	
W/Lock Nut & Bushing	3.05	(0.4)	. ↓	į.
Blank Cover	0.66	(0.1)	<u> </u>	<u> </u>
Total Standard Branch Circuit			***	400.3/
For Lighting	\$38.34	(2.4)	\$60.00	\$98.34

For each additional foot of Conduit Run, including wire, add \$2.84 to Total Cost shown above.

B. <u>Hi-Bay Installation</u>. Costs shown are based on installations inside a single story building in a non-hazardous area not over 20'-0" above floor.

	Material		Labor Cost	Makal Makadal C'Taban
Description	Cost	Manhours	@ \$25.00/Hour	Total Material & Labor
40 LF 3/4" Galvanized			1	!
Rigid Conduit	\$49.87	(1.6)		Ì
2 Ea. 3/4" Galvanized Elbow			•	1
W/One Coupling Each	10.92	(0.8)		Ĭ
130 LF #10 THW Copper Wire	17.38	(0.7)		•
6 Ea. 3/4" Pipe Straps	0.70	(0.4)		
l Ea. 4" Sq. Outlet Box			1 .	1
W/Lock Nut & Bushing	3.42	(0.4)	1	
Blank Cover	0.66	(0.1)	V	<u> </u>
Total Hi-Bay Branch Circuit			44.00	4100.05
For Lighting	\$82.95	(4.0)	\$100.00	\$182.95

For each additional foot of Conduit Run, including wire, \underline{add} \$3.32 to Total Cost shown above.

Notes:

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ittings

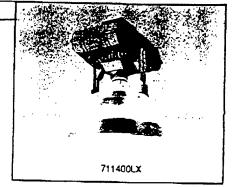
- The Standard Unit Prices shown in this Account were developed using costs from Accounts 16-1, 16-19 and 16-20 and include all material, layout, measurements for installation, handling the conduit and fittings, cutting and threading the conduit, installing the conduit and fittings, pulling the wires in the conduit, making wiring terminations, testing and checkout.
- 2. The Lighting Panel Board is not included; add from Account 16-44. The Lighting Fixture is not included; add from Account 16-60.
- 3. Refer to Account 16-90 for Circuit Feeders.

	Date 1/20/92	Page Pages	ALL-PHASE ELECTRIC City Denve	PRICE UNIT EXTENSION APPROX DELIVERY		\$ 23.00ea	-				l P	MC EI FOJ. # HEET I	J	ERS, PRC	INC JECT OF	38	Prepared By: Ken Cer
ASE ELECTRIC SUPPLY CO.	Bid Due	Job Name White Sands Gymnasium Location	Architect Engineer	IG NO. OR DESCRIPTION FUSED	Stonco	G.E.											ALL-PHASE ELECTRIC SUPPLY COMPANY'S PUBLISHED TERMS OF SALE, NI IS SUBJECT TO ALL MANUFACTURER'S PRICE IN EASES, TERMS AND CONDITIONS.
72-800-72 ALL-PHASE	Issued to:	Angie.		QUANTITY TYPE	===	110K 2500		00 8	or asi	#Hd 7	DH: (1)	90	:SI 2	260	7-JH		ALL-PHASE ELECTRIC SUPPLY COMPA HIS QUOTATION IS SUBJECT TO ALL MANUFACTURE

EMC ENGINEERS, INC **PROJECT** PROJ. # QO OF SHEET NO.

711 Series High Bay

250 watts to 400 watts High Pressure Sodium. Metal Halide



PRODUCT SPECIFICATIONS

APPLICATIONS

Indoor area lighting where ceiling mounting heights exceed 15 feet. Typica applications include warehouse facilities, assembly areas. gyms, hangers, transponation garages. loading and staging areas.

□ CONSTRUCTION

Light-weight, easy to handle balast housing die-cast aluminum. Unique design permits full flow-through ventilation for max-mum cooling of all components, includes integral roomy splice box with cover.

Heavy-gauge aluminum dust cap (enclosed

units). Protects lamp and reflector from dust and grime. Redirects up-light downward. Clear heat-tempered glass lens (enclosed L^1s), cushioned in double-gasketed extruded a uninum frame. Retained by stainless springcamps and safety bead-chain.

G alled porcelain lamp socket with plated emp-grip" screw shell and spring-loaded carter contact. Sockets in HPS units are \$35-rated for 4 KV. Enclosed units may be crafted with sockets mounted for extra-wide coam distribution.

ORDERING INFORMATION

Factored Ref. Reflector Reflector Specing/ Caralog No. * Caralog No. * Watts Lamp Size Finish Position Mtg. Htg. HIGH PRESSURE SODIUM

METAL HALIDE

.

711175MAEO 175 E28 BT28 des 15 Office 213 15 19 711250MAEO 250 E28 BT28 des 16 Diffuse 213 7 15 19 711400MA711400MAEO 400 E37, BT37, E18, des 17 50 Diffuse 213 7 18 16 17

e Standard H.I.D. units with constant wattage high power-factor autotransformer are available for 120V, 208V, 240V, 277V, and 480V. To specify, add desired voltage to Cat. No., e.g. 711400LX240V, For Multi-Tap ballasts suitable for field-selection of 120V, 208V, 244V or 277V, add s_fix "-MTB", OPhotometric distribution for enclosed units corresponds to position 3 or 4.

OPTIONS

To order the following factory installed options, add appropriate suffix to Cat. No.

FACTORY WIRING: 3-foot 3-conductor approved cable (14-3) and heavy-duty 20 amp twist-plug with proper NEMA configuration for specified voltage. Open-

loop hook included3CP FUSING: Heavy-duly fuses in external holder for easy, accessible service. For 120V and 277V. Single fusing FS For 208V. 240V and 480V.

Double lusing SWITCH-ON AUXILIARY LIGHT: Operates manually from secondary 120V source when HID circuit is "knocked out" by momentary voltage drop, Uses fully adjustable aluminum holder for PAR38 lamp to 150W. Fully adjustable for accurate aiming in critical areasEM HOT AND COLD START: Auxiliary light is switched on during both cold and hot start canditions and remains on until HID lamp has reached 70% of its cesigned brightness

SEMI-SPECULAR REFLECTOR: For use

ACCESSORIES

or a complete listing of Accessories-See page 41, 42.

□ OPTICS

Rigid heavy-gauge diffuse anodized aluminum reflector. Stopped parabolic design provides higher utilization of lamp energy with less trapped light. Cover has diffused surface for use with clear lamps. Semi-specular surface for use with coated lamps available (see Options).

- Reflector for open fixtures: Locks on die-cast adjustable aluminum straps.
- Reflector for enclosed fixtures. Gasketed and attached to reflector dust cap.

Die-cast aluminum reflector straps (open units). Slotted with cast-in numbered positions for field-choice of proper reflector position for maximum lighting efficiency. Reflector positioning is permanently labeled to outside of reflector. Refer to Section 11 for ohotometric data

□ BALLAST

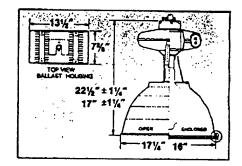
integral constant waltage high power factor autotransformer (CWA) ballast securely clamped in die-cast aluminum housing Capacitors are nested within integral "outboard" pods. Vented "air-flow" construction isolates heat-sensitive capacitors from heatgenerating core. Refer to Section 11 for electrical data.

☐ INSTALLATION

Rugged die-cast plate tapped 3/4" NPS. Accepts 3/4" pipe or 714/715 die-cast nook. Also accepts 725 steel hook. Unit stips onto mounting plate leaving both hands free for wiring, Ample splice chamber permits quick wiring.

□ LAMP

(Not supplied.) Scientifically positioned for optimum combination of light intensity and beam width, Refer to Section 11 for lamp data.



■ Stock Item; Normally carried in factory stock and/icr at local regional warehouses,

*ebruary 1390

For photometric, is to and electrical data, refer to Section 11

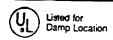
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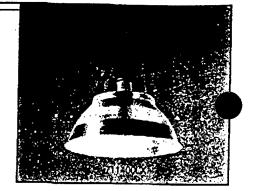
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PROJECT SHEET NO. _



711 Series High Bay

250 watts to 400 watts High Pressure Sodium. Metal Halide



PRODUCT SPECIFICATIONS

□ APPLICATIONS

Indoor area lighting where ceiling mounting heights exceed 15 feet. Typical applications include warehouse facilities, assembly areas. gyms, hangers, transportation garages, loading and staging areas.

□ CONSTRUCTION

Light-weight, easy to handle ballast housing die-cast aluminum, Unique design permits fult flow-through ventilation for maximum cooling of all components. Includes integral roomy splice box with cover.

Heavy-gauge aluminum dust cap (enclosed

units). Protects lamp and reflector from dust and grime. Redirects up-light downward. Clear heat-tempered glass lens (enclosed units), cushioned in double-gasketed extruded aluminum frame. Retained by stainless springclamps and safety bead-chain.

Glazed porcelain lamp socket with plated "lamp-grip" screw shell and spring-loaded center contact. Sockets in HPS units are pulse-rated for 4 KV. Enclosed units may be ordered with sockets mounted for extra-wide beam distribution

ORDERING INFORMATION

Catalog No. * Catalog No. * Watts Lamp

Reflector Reflector Spacing/ Size Finish Position Mtg. Htg.

HIGH PRESSURE SODIUM



■Standard H.I.D. units with constant wattage high power-factor autotransformer are available for 120V, 208V. 240V, 277V, and 480V. To specify, act desired voltage to Cat. No., e.g. 711400LX240V. For Muti-Tap ballasta suitable for field-selection of 120V, 208V, 244V or 277V, add suffix "-MTB". @Photometric distribution for enclosed units corresponds to position 3 or 4.

OPTIONS

विभागमात्री विभागमात्रिक्षा

To order the following factory installed options, add appropriate sulfix to Cat. No.

FACTORY WIRING: 3-foot 3-conductor

approved cable (14-3) and heavy-duty 20 amp twist-plug with proper NEMA configuration for specified voltage. Openloop hook included3CP

FUSING: Heavy-duty fuses in external holder for easy, accessible service.
For 120V and 277V. Single fusing -FS For 208V, 240V and 480V. Double tusing SWITCH-ON AUXILIARY LIGHT:

Operates manually from secondary 120V source when HID circuit is "knocked out" by momentary voltage drop. Uses fully adjustable aluminum holder for PAR38 lamp to 150W. Fully adjustable for accurate aiming in critical areas EM

HOT AND COLD START; Auxiliary light is switched on during both cold and hot start conditions and remains on until HIO lamp has reached 70% of its designed brightness -AMC SEMI-SPECULAR REFLECTOR; For use with coated lamp......sp

ACCESSORIES

For a complete listing of Accessories— See page 41, 42.

OPTICS

Rigid heavy-gauge diffuse anodized aluminum reflector. Stepped parabolic design provides higher utilization of lamp energy with tess trapped light. Cover has diffused surface for use with clear lamps. Semi-specular surface for use with coated lamps available (see Options),

- Reflector for open fixtures: Locks on die-cast adjustable aluminum straps.
- Reflector for enclosed fixtures: Gasketed and attached to reflector dust cap.

Die-cast aluminum reflector straps (open units). Slotted with cast-in numbered positions for field-choice of proper reflector position for maximum lighting efficiency, Reflector positioning is permanently labeled to outside of reflector. Refer to Section 11 for photometric data.

□ BALLAST

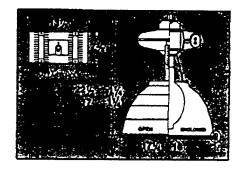
Integral constant wattage high power factor autotransformer (CWA) ballast securely clamped in die-cast aluminum housing. Capacitors are nested within integral "outboard" pods. Vented "air-flow" construction isolates heat-sensitive capacitors from heatgenerating core. Hefer to Section 11 for electrical data.

□ INSTALLATION

Rugged die-cast plate tapped 3/4" NPS. Accepts 3/4" pipe or 714/715 die-cast nook. Also accepts 725 steel hook. Unit slips onto mounting plate leaving both hands free for wiring. Ample splice chamber permits quick wiring.

□ LAMP

(Not supplied.) Scientifically positioned for optimum combination of light intensity and beam width. Refer to Section 11 for lamp data.



Stock Item: Normally carried in factory stock and/or at local regional warehouses.

February 1990

For photometric, lamp and electrical data, refer to Section 11.

STUNCU 🍱

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TEL NO:303-892-7109

194-20-.92 15:10 ID:ULL PHASE DENUER CO

EMC ENGINEERS, INC.	Steve Prawdzik 573-0222
PROJ. # PROJECT SHEET NO OF 38	
Sheet No o	cef
13/1dq. 1743 - Replace 118 200W, in the 70 8'-2-4	incandescent lamps, e flitures ube fluorement fixtures
118-500 W incandement lamps 436,600 lumens	5 @ 3700 lumens each =
total walls = 23	5,600
Replace with 70 8'2-tube fluor = 441,000 lumens to	
96 Watts/each Jamo	
. 75 watts/ballost	(\$)0 105 23940
DETWAR / FANCE	popopopopopo /
	7278
fixtures: 70 ea @ 205 = 14	
Lighting branch circuits:	
70 Fixtures ×167 = 176900 W	
	100v = 97,417A
· · · · · · · · · · · · · · · · · · ·	ircuit = 7 circuits
Circ	id
(D) (D) (G) (G)	\bigcirc \bigcirc
310, 510, 310, 510, 510	
182,95 182,95 182,95 182,95 182,95	
197.20 697.20	2 Add feet \$
880.15	7
000,10	= 6.161.05 TOTAL
Complian \$10.05/ Sixture × 118 Fixture	s = 1,185,90
	,
Total change	reout cost = \$21,696.95
+ Pero Steve Prawdzik @ N/H Lighting S	50~ = 1751) 1E 0/1/2 1/2+
Teld Chere I tuwazir - In/II cigit ting 5	167 Wif energy soving bellest

EMC ENGI	VEERS	. INC	_	
PROJ. #		VECT		
SHEET NO.	23	OF	38	

	xtures 4'-7-Tube	8'2-Tube		15010	DELL
	67	57	3	118 (HPS)	78 / 1C
4'2-Tul Con Prop	osed - [67 fixture ased - [67 fixture	s × 96 "Fixture] × 2 res > 71 "Fixture] × 2	210 TR = 14 1 210 TR = 10,5	4,720 12,970	
Hopose	it-L3 fixtures	× 181 "[Aixture] × 2 × 140 "[fixture] × 2	2210 HPS = 1,70	0,030	
S'2-To Corrent	be - [57 fixtures	× 177 ~ Sixture] =	× 2210 HRS =	21,666,840	
Hoposos	1. LS7 Jixtures	× 135 / fix tuse 1	- 2210 📆 =	1,1002'42'	
150101	HRZ		•		
1350					

EMC ENGIN	1EERS,	INC.		
PROJ. #	PRO	NECT		
SHEET NO	24	OF	38	 •

	Wattage Reduction =	Proposed 11,690	<u>Current</u> 23,600	25000000000000000000000000000000000000
		,		
-				
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zaciani dilici				

16-93

PAGE 1

THIS ACCOUNT PRESENTS THE RICHARDSON RAPID SYSTEM FOR ESTIMATING BRANCH CIRCUITS FOR LIGHTING INSTALLED. WORK PERFORMED BY AN ELECTRICAL CONTRACTOR.

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16-19, g the

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, fittings ckout.

A. Standard Installation. Costs shown are based on installations inside a single story building in a LIGHTING BRANCH CIRCUIT non-hazardous area, not over 12'-0" above floor.

non-hazardous area, not ov	er 12		Labor Cost	Total Material & Labor
•	Material Cost	Manhours	@ \$25.00/Hour	Total material
Description 20 LF 1/2" Galvanized	\$20.11	(0.8)		
Rigid Conduit 2 Ea. 1/2" Galvanized Elbow W/One Coupling Each E IF #12 THW Copper Wire	9.00 5.32 0.20	(0.7) (0.3) (0.1)		
2 Ea. 1/2" Pipe Straps 1 Ea. 4" Sq. Outlet Box W/Lock Nut & Bushing	3.05 0.66	(0.4)	+	\$98.34
Blank Cover Total Standard Branch Circuit	\$38.34	(2.4)	\$60.00	chown above.

For each additional foot of Conduit Run, including wire, add \$2.84 to Total Cost shown above.

Hi-Bay Installation. Costs shown are based on installations inside a single story building in a non-hazardous area not over 20'-0" above floor. Labor Cost

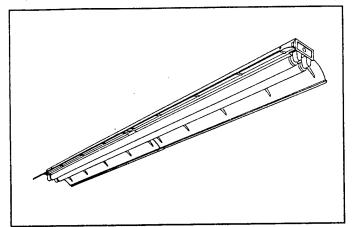
non-hazardous area not or			Labor Cost	Total Material & Labor
	Material Cost	Manhours	@ \$25.00/Hour	Iotal the
Description 40 LF 3/4" Galvanized	\$49.87	(1.6)		
Rigid Conduit 2 Ea. 3/4" Galvanized Elbow	10.92	(0.8)		
II II/One Counting Daci	17.38	(0.7) (0.4)		
130 LF #10 THW Copper Wire 6 Ea. 3/4" Pipe Straps	0.70	•		† _
Ea. 4" Sq. Outlet Box W/Lock Nut & Bushing	3.42 0.66	(0.4) (0.1)	<u> </u>	\$182.95
Blank Cover Total Hi-Bay Branch Circuit		(4.0)	\$100.00	\$102.93
For Lighting	\$82.95		1 \$3.32 to Total Cost	shown above.

For each additional foot of Conduit Run, including wire, add \$3.32 to Total Cost shown above.

Notes:

- 1. The Standard Unit Prices shown in this Account were developed using costs from Accounts 16-1, 16-19 and 16-20 and include all material, layout, measurements for installation, handling the conduit and fittings, cutting and threading the conduit, installing the conduit and fittings, pulling the wires in the conduit, making wiring terminations, testing and checkout.
- 2. The Lighting Panel Board is not included; add from Account 16-44. The Lighting Fixture Ls not included; add from Account 16-60.
- 3. Refer to Account 16-90 for Circuit Feeders.

EMC ENGINEERS, INC. PROJECT PROJ. #____ DL OF 38 SHEET NO. _



CSR296 CSR INDUSTRIAL TWO LAMP SLIMLINE

ТҮРЕ	
JOB INFORMATION	

FEATURES:

alebabiliansi.

- · Solid reflectors with optional uplight.
- · Telescopic spring loaded lampholders.
- · 21/2" lamp spacing.
- · For individual or continuous row mounting.
- · Channel ends double as joiners.
- · Reflector aligners supplied on 8' fixtures.

SPECIFICATIONS:

BALLASTS

75 watt Slimline, thermally protected, automatic resetting, Class P, high power factor, CBM, unless otherwise specified.

HOUSING

Die formed steel with knockouts for stems or chain hangers.

REFLECTOR

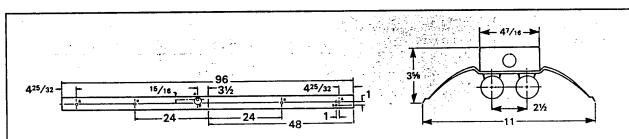
Die embossed with transverse ribs for maximum rigidity. Available wtih apertures for uplight.

FINISH

All parts pre-painted with high gloss baked white enamel, minimum reflectance 86%, applied over iron phosphate pre-treatment for maximum adhesion and rust resistance.

LABELS

All fixtures carry the U.L. label.



- A %" Diameter Knockout
- B .570 x .656 Strain Relief Knockout
- F 2" Diameter Knockout
- R 11/16" Diameter Knockout

NOTE 1: All Non-Shielded (strip) fixtures—Deduct 1/16" from overall dimension for continuous row mounting. Dimensions shown include end panel. NOTE: All dimensions are in inches; dimensions are subject to change without notice. Please consult factory or check sample for verification.

Recommended Hanging Accessories



ZT-60F Zip Tee Hanger



ZT-60 Zip-Tee Hanger



CS-2 Ceiling Spacer



S-18 Stem and Canopy Set



CL-60 Slide Clamp Hanger



HC-3 Chain Set

KEYSTONE LIGHTING

P.O. Box #700, Bristol, Pennsylvania 19007 TEL. (215) 788-0811

1-28

CSR296

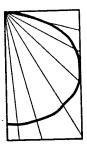
TWO LAMP SLIMLINE

CSR INDUSTRIAL

Photometric Data

COFFFICIENTS OF UTILIZATION

RC	8		5	0
RW	50	30	50	30
0	102	102	96	96
1	89	85	83	81
2	77	71	73	68
3	68	61	64	58
4	60	52	56	50
5	52	44	49	43
6	46	38	44	37
7	42	34	39	33
8	37	29	35	29
9	33	26	32	25
10	30	23	29	22



RF-20

distantantia

Ballast Factor: .95, Lamps Rated at 6300 Lumens each S/MH: PARL 1.27 NORM 1.46

For complete photometric report contact factory.

CANDLEPOWER

DEG	PARL	NORM
0	3056.	3056.
		3043.
5	3077.	
10	3030.	3070.
15	2966.	3070.
20	2875.	3053.
25	2763.	3020.
30	2621.	2983.
35	2456.	2918.
40	2274.	2844.
45	2072.	2729.
50	1852.	2584.
55	1616.	2375.
60	1383.	2163.
65	1110.	1920.
70	840.	1535.
75	567.	1098.
80	307.	660.
85	100.	262.
90	8.	1.

ZONAL LUMEN SUMMARY

ZONE	LUMENS	LAMP	FIXT.
0- 30	2480.	19.7	22.9
0- 40	4175.	33.1	38.5
0- 60	7910.	62.8	72.9
0- 90	10848.	86.1	100.0
90-180] o.	0.0	0.0
0-180	10848.	86.1	100.0

Ordering Information

Example Complete Catalog Ordering Number: CSR 2 96 A 120 LE EL FF4

CSR 296 SERIES VOLTAGE 120 or 277V No. OF LAMPS INDUSTRIAL OPTIONS LAMP WATTAGE. **Energy Saving Ballast** LE Emergency Battery Pack Fast Blow Fuse

FF4

GN

A = APERTURED REFLECTOR FOR UPLITE

INDUSTRIAL ACCESSORIES

ORDER SEPARATELY Zip Tee Hanger - flush mount on tee bar ceiling
Zip Tee Hanger - 1½" spacer on tee bar ceiling
Slide Clamp Hanger
18" Stemp Page 100 11" ZT60F

ZT60 CL60

18" Stem, canopy and 8° aligner S-18 ITB4

Close mounting on Tee Bar ceiling

14" Chain Hangers HC3

For complete list of options and accessories, see options and accessories section.

Plug-on Wiring System - see options section for details

Approvals Fixture Schedule Catalog Number Type



P.O. Box #700, Bristol, Pennsylvania 19007 TEL. (215) 788-0811

				EMC ENGINEERS, INC. PROJECT PROJECT
	1751 -Li		-2	SHEET NO. 29 OF 38
4.7.10pe	4'4-Tube 8'D	Tube bow	The looky	Ínc.
4'2-Tube Current Proposed		es × 96 Wfixture es × 71 Wfixture	2) × 2210 HR	-= 39,673,920 == 29,342,170
4' 4-Tube				
Current Proposed		x 181 W fixture	× 2210 HRS	- 2,400,060 - 1,856,400
8'D-Tube		100 WC 1 7	HRS	
Corrent Proposed	- [3 fixtures ?	< 172 "Fixture] × 135 "Fixture]	× 2210 +PS	1,140,360 = 895,050
		<u>.</u>		

	Building	1753- Lighti	ng ECO			
	4'2-Tube	()		150 WInc.	756) For	6'9-70e
_	33	4 (9FF)	26	2	14	2,(off)
			(BAY)			
				-		
-	4'2-Tube	[00]	016/01/27	HRS HRS	= 7001080	7
_	Corrent - Proposed -	[33 fixtures x	< n w fixture	× 2210 + 22	= 5,178,03)
					•	•
-						
_						
. .	200 W Inc					
+						
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EMC ENGIN	IEERS,	INC	•
PROJ. #	PRC	JECT	•
SHEET NO.	31	_OF_	38

	- Lighting E				•	
11 lercury	DOW Inc	44-Tube	4 D-lube	•	-	
85	13	ها	8			
(BAY)	(BAY)					
4 4-Tube						
Current - Ll Proposed - Do	e fixtures x 1	81 "Sixtore	7×5510;	XX = 0,40	040,00	
Hoposed - 16	fixtures ×	140 4 Fixtur	50/×5510	FR : 1,85	36,400	
4' 2-Tube			م مر لد			
Current - [8] Proposed - [8]	rixtures × 96 h	1/fixture x	2210	-1697,29	<i>8</i> 0	
Luboerg - 787	tixtures ×71°	4 fixture 1 x	2210	- : 1,755,7	<i>C8</i> 2	
Morrory Vapo	^	AND THE RESIDENCE OF THE PARTY				
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A CONTRACT TO THE STATE OF THE			<u>.</u>			
Nacio E						
DOOM Inc.				NA W 14 11M 1917 1 TOWN 2	and a common with the	
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	<u></u>		1.1. That is the second of the			
		······································			THE STANDARD BY AREA	
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	131dg. 1790 - 15 High		
	- 84 Mercury Vapor Multi Vapor - (Me HPS -	n - (800 W) 43 Hat Halide) (250) PRITE (lumens/watt
- - -	Metal Ha	lides 190 w/fixture 205 w/fixture	
-	175 - 220		
- - -		Vapor - 400 WATT	(if 400 - Use GE I-Line for use as direct
 i_		Clear -	Replacement -
	Ballast Recommendation 1	ist	halide
- -คระบาทสมัยสิทธิ์ 	325 W-	Mork	Any other watage 1000?
-		\$80°C	00
-			
_			
-			

225 SK/FIXTURE = 20,000 lumens december 1 15 x 15 50FC x 225 SF = 18,900 lumens 2500 mH => 18000 - 20,000 Coated

EMC ENGINEERS, INC.

	Draw on incandescents
	Deaw on Fluorescents Chiferent wattages
_	Deaw on Matal Halides
_	175 to Metal Halide = 205 Vfixture
	250 W Metal Halido = 800 watts/fixture
	uetrofitting
_	400 w Mercury Yapor = = 4460 watts total
-	

		PROJ. # PROJECT
		SHEET NO. 35 OF 38
	Building 1794 - Lighting ECO	
	Mercury	
***************************************	Vapor 300 W.Tm. 4'1-Tube	•
	(BAY) (BAY)	
	Mercury Vapor	
	Current: [48 fixtures × 400 / fixture] × 2210 TR =	
	Proposed (High pressure sodium)	
	Proposed: (High pressure sodium) [48 fixtures x 250 "Sixtures x 2510 #25 =	
<u></u>		
	BOOW. Inc.	
	4'2-Tube	
	Corrent - To fixtures × 96 Whixture] × 2210 TR . 1,271 Proposed - To Sixtures × 71 Whixture] × 2210 TR = 94	2,960 1,410

	Building 1830 - Lighting ECO 4'2-Tube 4'4-Tube 150 wine 10 wine 157 52
	4'2-Tube Corrent- [157 fixtures × 96 w fixture] × 2210 +185 = 33,309,120 Proposed - [157 fixtures × 71 w fixture] × 2210 +185 = 24,634,870
	4'4-Tube Current - [52 fixtures x 181 Wfixture] x 2210 #2 = 20,800,520 Proposed - [52 fixtures x 140 Mfixture] x 2210 #2 = 110,088,800
rájúi	
-	
- 14 T A	

	EMC ENGINEERS, INC.
	PROJ. # PROJECT
Bilding 1845 - Lighting ECO	
DOOW Inc U'D-Tuk	
76	
(profesion and Dutines)	
(explosion-proof fixtures) (says he never uses these lights)	
Casto the the sels moss flience intiles)	
200W Tra.	
412-Tube	
Corrent - [6 fixtures × 916 / Sixture] × 2 Hoposed - [6 fixtures × 71 / fixture] × 2	2210 #85 = 1272 910
Annead - Cla Sixtores & 71 4 Fixtore Txx	210 HRS . 941 410
Toposed Le 11x 10125 - 11 1 11x 1012 - C	210 72 111, 100
	·

OACOUNTED BY: HALLS DATE: 13-17-92. CHECKED BY: DATE.

LIGHTING ENERGY SAVINGS CALCULATIONS

	SIMPLE	PAYBACK					6.82				8.34			8.39					4.75				5.13			8.90			8.26		2.87
CONSTRUCTION	COST	ш					\$30,518.72				\$11,869.65			\$8,464.65					\$10,167.81				\$25,989.61			\$15,253.27			\$350.65		\$7,521.93
ANNOAL	ELECTRICAL	COST SAVINGS	\$473.76	\$596.51	\$34.79	\$3,368.64	\$4,473.70	\$1,322.28	\$69.58	\$31.40	\$1,423.26	\$233.34	\$774.98	\$1,008.33	\$1,277.03	\$735.39	\$69.58	\$56.57	\$2,138.56	\$2,307.98	\$2,715.27	\$42.43	\$5,065.68	\$1,110.15	\$603.02	\$1,713.17		\$42.43	\$42.43	\$2,617.82	\$2,617.82
ENERGY	SAVINGS	(KWH)	3701.8	4660.9	271.8	26321.1	34955.6	10331.8	543.7	245.3	11120.7	1823.3	6055.4	7878.7	9978.1	5746.0	543.7	442.0	16709.8	18033.6	21216.0	331.5	39581.1	8674.3	4711.7	13386.0		331.5	331.5	34594.6	34594.6
DEMAND	WR # FIXTURES TYPE FIXTURE TOTAL KWHMR REDUCTION	(KW)	1.675	2.109	0.123	11.910	15.817	4.675	0.246	0.111	5.032	0.825	2.740	3.565	4.515	2.600	0.246	0.200	7.561	8.160	9.600	0.150	17.910	3.925	2.132	6.057		0.150	0.150	7.920	7.920
	KWH/YR		10512.9	17005.9	928.2	25834.9	54282.0	29342.1	1856.4	895.05	32093.6	5178.03	5436.6	10614.6	75416.2	0	1856.4	1255.28	78527.9	30763.2	0.0	941.5	31704.7	24634.9	16088.8	40723.7		941.5	941.5	15200.6	15200.6
	TOTAL	(KW)	4.757	7.695	0.420	11.690		13.277	0.840	0.405		2.343	2.460		34.125	0.00	0.840	0.568		13.920	0.000	0.426		11.147	7.280			0.426		3.480	
PROPOSED	FIXTURE	(KW)	0.071	0.135	0.140	0.167		0.071	0.140	0.135		0.071	0.205		0.408	0.000	0.140	0.071		0.290	0.000	0.071		0.071	0.140		<u>ত</u>	0.071		0.290	
PRC	TYPE		교	교	ı,	교		료	교	료		료	ĭ		¥		료	Ŧ		¥		교		교	럾		ALYZIN	교		¥	
	# FIXTURES		67	22	e	2		187	60	e		88	12		84	0	9	60		48	0	60		157	52		EXPLOSION-PROOF FIXTURES - NOT ANALYZING	80		12	
	KWH/YR		14214.7	21666.8	1200.0	52156.0	89237.6	39673.9	2400.1	1140.4	43214.3	7001.3	11492.0	18493.28	85394.4	5746.0	2400.1	1697.3	95237.7	48796.8	21216.0	1273.0	71285.8	33309.1	20800.5	54109.6	JE FIXTUR	1273.0	1273.0	49795.2	49795.2
	TOTAL	(KW)	6.432	9.804	0.543	23.600		17.952	1.086	0.518		3.168	5.200		38.640	2.800	1.086	0.768		22.080	9.600	0.576		15.072	9.412		N-PRO	0.576		11.400	
EXISTING	FIXTURE	(KW)	0.096	0.172	0.181	0.200		0.096	0.181	0.172		0.096	0.200		0.460	0.200	0.181	0.096		0.460	0.200	0.096		0.096	0.181		EXPLOSIO	0.096		0.200 11.400	
Ш	TYPE		료	료	료	Z		교	료	교		교	Z		≩	Z	교	귍		≩	Z	교		교	€		Z	귙		Z	
	BLDG. # HRS/YR # FIXTURES TYPE FIXTURE TOTAL		29	22	ო	118		187	80	ო		33	26		84	. 13	9	∞		48	48	ဖ		157	52		76	60		22	
	# HRS/YR		2210	2210	2210	2210		2210	2210	2210	`	2210	2210		2210	2210	2210	2210		2210	2210	2210		2210	2210			2210		4368	
	BLDG.		1743					1751				1753			1790					1794				1830			1845			236	

KEY:

FL = FLUORESCENT IN = INCANDESCENT MV = MERCURY VAPOR MH = METAL HALIDE

These problems are compounded in still another way. Daytime staff may assume around-the-clock controls are in place. Or, they may never have been informed as to the purpose of a certain switch or lever. In some instances, operating personnel may be inclined to espouse adherence to standards and conditions they "ought" to follow, rather than own up to actual conditions. As a result, those who have done "midnight raids" on facilities frequently report that systems are not running as described.

Equipment age, inadequate or inappropriate maintenance and repairs all contribute to operations that stray from design specs. These problems are compounded by changing contaminant loads and equipment loads; so, even if equipment were operating at design once upon a time, chances are the current needs are no longer served.

These fallacies only begin to reveal how many maintenance problems are rooted in misunderstandings, misconceptions, and the lack of the "right" information. All of which points to the vital role training holds in maintaining a staff qualified to do the job.

G Bulwer Lytton once observed "The pen is mightier than the deword." When it comes to achieving a productive cost-effective environment, this sage comment might be paraphrased, "The pen is mightier than the screwdriver." To put it another way, a well-trained O&M staff is widely regarded as the most effective "tool" in implementing an IAQ program.

These two activities—O&M staff training, and a solid PM program for this staff to implement—are imperative if an indoor air quality affort is to succeed

About the Author

Dr. Shirley Hansen is a leading authority in the field of energy management in nonprofit institutions. Her experience is backed by more than twenty years as a manager, educator, author and lecturer. Prior to founding Hansen Associates in 1980, Dr. Hansen was the Director of the Schools and Hospitals Conservation Division of the U.S. Department of Energy. Her interest in maintaining comfortable, healthy and energy efficient buildings led her into the indoor air quality field. She has presented papers at national and international conferences on optimizing indoor air quality and energy efficiency and on preventive strategies to maintain quality indoor air.

Dr. Hansen's new book, *Managing Indoor Air Quality*, will be released in the fall of 1990. 6" x 9", hardcover, \$62.00, The Fairmont Press, 700 Indian Trail, Lilburn, GA 30247.

AN ENERGY/ECONOMIC ANALYSIS

Performance of Retrofit Optical Reflectors (Performation)

JEFFREY KESSEL, P.E., Associate Engineer Energy Conservation Office University of California at Berkeley PRIOR TO AWARDING A MAJOR CONTRACT TO INSTALL RETROFIT OPTICAL reflectors at the University of California at Berkeley, the Department of Facilities Management made a detailed study of the performance of the candidate reflectors. The results were used to predict lifecycle cost of these reflectors when used with commercially available partial light-output ballasts.

Performance-based credits were given to the bids of the better-performing reflectors.

Key findings of the research are as follows:

- 1. If a mirror-like reflector is installed in a luminaire in conjunction with removing half its lamp complement, then the resulting lights levels (footcandles) were found to be 59 percent to 73 percent of the original, depending on design and material of the reflector. Note that the higher value is almost equivalent to getting three lamps worth of light from two lamps.
- 2. There is a 16 to 19 percent decrease in uniformity of light level over the room.
- better performing reflectors for the purpose of contract award, based on the premise that a 20 percent more efficient reflector could give the same amount of light as its competitor while saving 20 percent of energy costs by using a partial light output ballast.

The installation of a specular optical reflector into a fluorescent luminaire, accompanied by removal of some lamps and ballast, has gained acceptance as a means to decrease lighting energy use by nearly one-half, without losing a proportional amount of useful light.¹ Other investigators^{2,3} have found that illuminance levels decreased to 58-65 percent of original levels after similar modifications. These results agree with photometric data from one luminaire manufacturer⁴ who offers several luminaires in two versions, differing only in the reflector material.

The CU tables show an increase of 11-26 percent in the CU values of the specular fixture relative to the new fixture with standard white diffuse reflector. Other manufacturers offer new fixtures with specular reflectors.⁵ Because specular reflectors are incorporated into the design from the beginning, rather than as a retrofit add-on, we may expect to see still higher efficiencies and greater uniformity of illuminance.

As part of the contracting procedure in the Lighting Modification Program of the Department of Facilities Management at the University of California at Berkeley, we carried out a study to quantify this effect. In order to show the range of possibilities for this type of retrofit, we selected two different luminaire types in the same building for the performance test.

Four reflector manufacturers produced prototypes for testing encompassing design and material of their choice, and submitted bids to supply the reflectors. In order to encourage use of superior design and materials we incorporated into our request for bids a procedure to give performance-based credits to the bids of the better performing reflectors. Our results should be characteristic of the performance obtainable from retrofit specular reflectors designed under competitive conditions.

Two fixtures, (Type I, a 2' \times 4' 4F40 with a wrap-around clear prismatic pattern #12 lens, and Type II, a 1' \times 4' surface-mounted 2F40 with a flat clear prismatic pattern #12 lens), were loaned in the summer of 1987 to four reflector contractors for design of prototype reflectors, to be submitted with a bid to supply and install 1550 and 1000 units, respectively. The request for bid specified the manner in which a credit, proportional to performance, would be applied to the bids. The reflectors produced were of different design and materials, and are representative of typical commercially available products. The fixture and reflector characteristics are listed in Table 1.

Performance of Retrofit Optical Reflectors

Table 1. Optical Reflector Characteristics

	Ref-1	Ref-2	Ref-3	Ref-4
040	Anod. Alum. Full coverage Relocate R=%Base Flux=64 Bid=\$40.39 Adj. Bid=\$29.84	Anod. Alum.+DEO Full coverage Relocate R=71 \$40.80	Anod. Alum. Full coverage No relocate R=59 \$39.33	Silv. Laminate Full coverage No relocate R=71 \$63.06
=	Anod. Alum. Full coverage Relocate R=65 \$40.01	Anod. Alum.+DEO Full coverage Relocate R=71 \$27.50	Anod. Alum. Partial coverage No relocate R=61 \$37.82	Silv. Laminate Full coverage No relocate R=73 \$46.14 \$31.35

Note

Type I is a 2' \times 4' pendant-mounted 4F40 with wraparound prismatic lens. Type II is a 1' \times 4' 2F40 surface-mounted fixture with flat prismatic lens.

Partial or Full Coverage refers to the size of the reflector relative to the size of the fixture. Relocate indicates that the original socket holders were removed and replaced with relocated sockets.

Anod. Alum. is high quality anodized aluminum. DEO indicates the addition of a dielectric overcoat to increase reflectance. Silv. Laminate refers to a coating of elemental silver deposited on plastic sheet which is adhered to aluminum substrate.

The Bid prices quoted were to clean the fixture and to supply and install the reflector (and socket mounting brackets, if any), to supply and install lamps, and to install a ballast supplied by the University. The Adjusted Bid is the performance-adjusted bid price as explained below in the section on Reflector Selection.

R=% Base Flux=% of flux from original fixture (after being cleaned and relamped).

Performance of Retrofit Optical Reflectors

PROCEDURE

The test procedure was similar for categories I and II. Both test luminaires were over twenty years old, and had rarely been cleaned. A classroom measuring 26.5 ft x 37.0 ft x 14.7 ft high, with fixtures suspended at 9.0 ft height, was selected for the Category I test. An office measuring 17.0 ft x 21.0 ft x 9.8 ft high, with fixtures suspended at 9.5 ft height, was selected for the Category II test.

First a fixture located near the center of the test room was thoroughly cleaned, and fitted with a full complement of 40-W F40/CW lamps which had been operated under controlled conditions in a lamp-life test rack for 4000 hours. The fixture's 277 V ballast was removed and replaced with energy efficient 120 V core and coil ballast (Advance R-2S40-1-TP for Category I, and Universal 412-L-SLH-TC-P for Category II) operating initially the full lamp complement, and subsequently one-half the lamps in the modified fixture. The test ballast was powered by a line voltage regulated power supgly to ensure that illuminance measurements of modified fixtures would be obtained at the same power level.

Power consumption was monitored with a TIF 2000 Wattprobe,

Power consumption was monitored with a TIF 2000 Wattprobe, and found to remain within a 2 percent range during illuminance measurements on the test grid by means of a Tektronix J65 illuminance probe. All luminaires in the room were switched off except for the test fixture. Air temperature near the test fixture was monitored with a Fluke Y8103 Type K thermocouple, and building fans were switched off in a successful effort to maintain the room at constant temperature (20.5 C).

A test grid of twelve points, 2.5 ft above the floor, was laid out in one 8.65 ft x 8.75 ft quadrant of the luminaire. Figure 1 shows the grid for the two tests. Each reflector contractor in turn installed his reflector, most choosing to relocate lamp sockets as part of their design. The test lamps and the sockets were marked to ensure that each reflector was tested with the same lamps installed with the same orientation (end-for-end and rotationally about lamp axis). There was, of course, some lateral displacement of the lamps depending upon the contractor's design location for the lamp sockets. After waiting 10 minutes until the power consumption stabilized, illuminance measurements were taken on the grid.

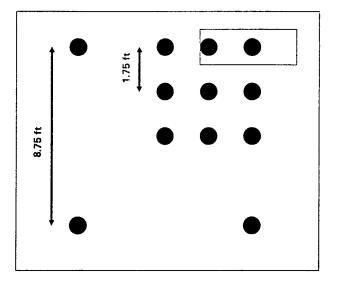


Figure 1. Photometer Locations

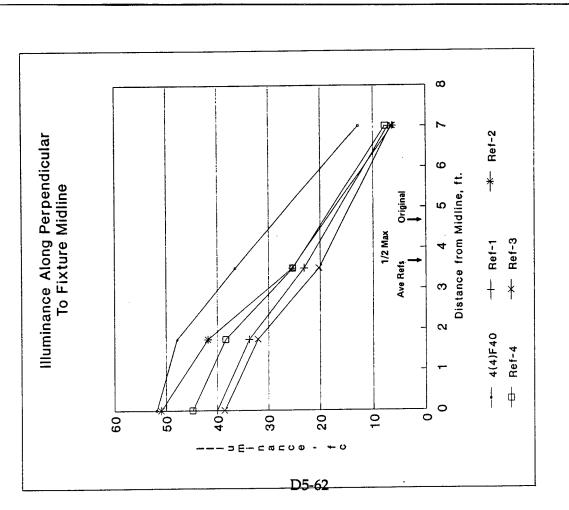
ESULTS

The measured power decreased, for the Category I luminaire, from 163 W (unmodified, 4 lamps) to 91 W (modified, 2 lamps). The unmodified Category II luminaire's power was not measured because it was powered by its original 277 V 2F40 ballast during the baseline (unmodified) illuminance measurements.

In Table 1 the photometric results are summarized by stating R, the percent of unmodified (base) luminaire flux delivered by the modified luminaire. This ranged from 59-71 percent for Category I, and from 61-73 percent for Category II.

Figures 2 and 3 plot the illuminance along a line perpendicular to the luminaires' major axis. The decreased lateral light distribution attributable to the reflectors is indicated by a 16-19 percent decrease in the distance at which the illuminance drops to one-half its maximum value (as indicated by the arrows labelled 1/2 Max).

Performance of Retrofit Optical Reflectors



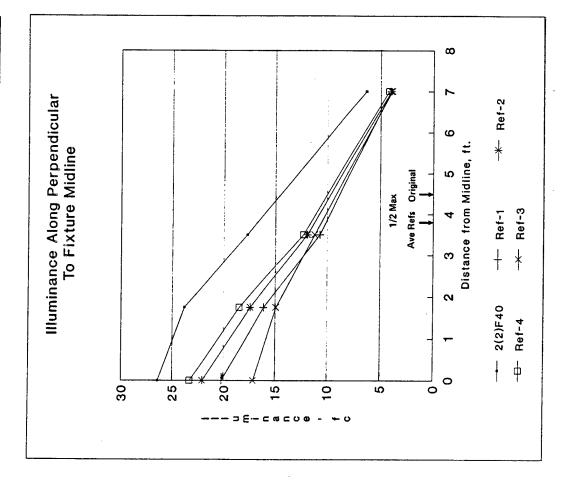


Figure 3. 2(2) F40 and 2(1) F40 + Reflector

REFLECTOR SELECTION

Rather than award the contract to the low bidder, the request for bids specified award to the low bidder after a downward adjustment that was proportional to the relative performance of the reflectors. This adjustment factor is derived as follows:

Let R be the ratio of flux delivered to four quadrants by the modified luminaire relative to the unmodified luminaire: (delamped and reflectorized)/(fully-lamped basecase).

Consider two reflectorized fixtures, 1 and 2, with ratios R1 < R2, (R calculated relative to the fully-lamped basecase). By using commercially available "tuned" partial light output ballasts we can operate the poorer performing reflector at full power, Power1=W, and the better performing fixture 2 at partial power, Power2, so that its resultant ratio R2 equals that of fixture 1 operated at full power. That is, decrease Power2 until

Power1 / Power2 = W/Power2 = R2/R1.

General Power 1 — Power 2 = W * [1 — (R1/R2)].

Therefore the life cycle avoided energy cost of retrofit fixture 2 relative to retrofit fixture 1 is, per fixture:

[1-(R1/R2)] *(W watts) *(0.001 kWh/watt) * (H hrs/yr) * (E \$/kWh) * [P/A],

where W=ballast power, H=annual operating hours, E=current cost of electricity, and [P/A] is the present worth factor encompassing anticipated lifetime, discount rate, and energy cost escalation rate.

In our contract award, this avoided energy cost factor was used to adjust downward the bids of the better performing reflectors. Thus all retrofit fixtures were evaluated as if they operated with partial power so as to have the same illuminance ratio as the worst performing reflector (which itself in effect receives an adjustment of \$0.00).

The rationale for this adjustment is that we select as candidate spaces for reflector retrofit those spaces calculated (or measured) to have a factor of excess illuminance which we anticipate will be "corrected" by delamping and installation of a poorer performing reflector. The extra illuminance provided by a better performing reflector may be captured as energy savings through the use of partial light

Performance of Retrofit Optical Reflectors

output ballast, or may be allowed to remain as an amenity with the use of full power ballast.

These adjustments ranged from \$10.55-\$22.82 for Category I (W=60, H=3000, E=0.075, and [P/A]=10), and from \$5.54-\$14.79 for Category II (W=30, H=4000, E=0.075, and P/A=10). The adjusted bids are shown as the last entry for each reflector in Table 1.

CONCLUSIONS

The removal of one-half the lamps combined with the installation of specular optical reflectors as a retrofit modification for fluorescent luminaires resulted in useful delivered flux in the range of 60-73 percent of that obtained with a cleaned older fully-lamped luminaire. This performance range is a function of reflector design and material. Lighting energy use can be approximately halved in spaces that can tolerate both a decrease in illuminance of this magnitude, and a decrease in uniformity characterized by a decrease of around 16 percent in the half-peak spacing.

This range in reflector performance can be quantified and used as input to a life-cycle cost analysis which in turn can be used to adjust the bid prices for award of a contract.

ACKNOWLEDGEMENTS

The author wishes to thank Robert Clear and Rudy Verderber of the Lighting Systems Research Group at Lawrence Berkeley Laboratory for their encouragement and helpful suggestions and comments.

REFERENCES AND FOOTNOTES

- 1. Chester K. Johnston, "Lighting Energy Management—With Reflectors," Facilities Manager, Vol. 1, No. 4, Winter 1985.
- 2. D. L. DiLaura and D. G. Kambich, "Luminaire Retrofit Performance—Commercial Building Lighting Systems," March 1987, EPRI Report EM-5094, Palo Alto, CA 94304.
 - 3. T. K. McGowan, Fluorescent Fixture Reflector Inserts, General Electric Technical Information Series, No. 4162-871A, January 22, 1987.

- Fixtures 101, 103, 325 are offered with and without a silver-laminate specular reflector. Wellmade Metal Products, Oakland, CA.
 - Brayer Lighting, San Francisco, CA <u>ن</u>

Wellmade Metal Products, Oakland, CA Maximum Technology, Brisbane, CA

Electronic Ballast Technology, Inc., Torrance, CA. ဖ

About the Author

and is a registered professional engineer in the state. For the past four years he has directed the Campus Lighting Efficiency Improvement Project for the Energy Conservation Unit of the Office of Physical Resources of the University of California at Berkeley. Prior to that he was a staff scientist at Lawrence Berkeley Laboratory where he conducted research on energy-efficient windows Jeffrey Kessel, P.E., is a graduate of the University of California at Berkeley, and daylighting.

The Collaborative Process in Strategic Energy Planning

The Collaborative Process in Stragic Energy Planning

LARRY B. BARRETT Barrett Associatès

tion. Traditionally, utilities made their plans first and then sought A GROWING TREND FOR ENLIGHTENED ELECTRIC UTILITIES IS TO OPEN UP regulatory approval. Now, more and more utilities are seeking input the process of planning for capacity additions and energy conservainto their plans from intervenors and others before approaching reguatory authorities.

Factions which were once adversaries in the hearing room may be found working more cooperatively in the conference room.

This is called the "Collaborative Process,"

Typically, parties involved in the collaborative process are staff from the utility commission, the office of the consumer advocate and the state energy office. Environmental groups are also well represented.

In some cases customers are invited into the process. Usually the participating customers are large commercial and industrial energy consumers served by the utility. In a few cases, small customers are

WHAT IS THE COLLABORATIVE PROCESS?

The process has become known as the collaborative process in However, other states have been active for some time. The Nevada Wisconsin, Michigan, and the District of Columbia have instituted a collaborative process.² Public Service Commission and electric utilities in Nevada started using a collaborative process in 1983. More recently, the states of New England where it has been practiced most heavily since 1988.1

E M C ENGINEERS, INC. Denver • Colorado Springs • Atlanta • Germany

JOB WSMR	ESC	20
SHEET NO.		OF
		DATE 8 JUN 92
CHECKED BY	 .	DATE
SCALE		

ITULIAN:

WE USED THE NEW US DEPT OF LABOR RATE FOR

ELECTRICIAN THAT I FATED TO YOU (\$ 33.87/M)

AND REDID THE LIGHTING ECOS FOR 21751 \$ 1830,

THEN WEDID THE LIGHTING ECOS FOR 21751 \$ 1830,

USING HI EREO ELECTRONIC BALLASTS W/ RATE

EMETH OHOS PHOR LAMP TECHNOLOGY. THE

COMPARISONS ARE SHOWN BELOW. WE WILL REPUN

THESE ROLTHS REPORT USING \$27.60 MM. LABOR RATE,

WHICH IS THE CORRECT RATE.

UNITHIS ER. HIFPER

398 SIR SPB SIR

	WATER	SER	1 HIFE	EO
	SPB	SIR		SIR
1751	4.6	3,24	6.0	2,46
1830	4,8	3,05	6,3	2.35

CONCLUSION: AT THE # 0,0221/KWH \$ 19,50/KW
FOR WINE, THE HI FRED LIGHTING DOESN'T PAY
AS WELL AS THE REDUCED WATTAGE LAMPA BALLAST
TECHNOLOGY. THE EQUIPMENT COST IS STILL TOO HIGH.

WASTIMSER

__ DATE: __ DATE 9 CALCULATED BY: PAGE

LIGHTING ENERGY SAVINGS CALCULATIONS

	CONSTRUCTION	COST	ESTIMATE					\$30,518.72				\$5,841.84			\$8,464.65					\$10,167.81				\$25,989.61			\$7,464.86			\$350.65		\$7 521 93
	ANNOAL	ELECTRICAL	COST SAVINGS	\$473.78	\$596.51	\$34.79	\$3,368.64	\$4,473.70	\$1,326.41	\$69.80	\$31.49	\$1,427.70	\$233.34	\$774.98	\$1,008.33	\$1,277.03	\$735.39	\$69.58	\$56.57	\$2,138.56	\$2,307.98	\$2,715.27	\$42.43	\$5,065.68	\$1,113.62	\$604.90	\$1,718.52		\$42.43	\$42.43	\$2,617.82	CO R17 89
	ENERGY	SAVINGS	(KWH)	3701.8	4660.9	271.8	26321.1	34955.6	10518.8	553.5	249.7	11322.0	1823.3	6055.4	7878.7	9978.1	5746.0	543.7	442.0	16709.8	18033.6	21216.0	331.5	39581.1	8831.3	4797.0	13628.2		331.5	331.5	34594.6	2AEGA R
IONS	DEMAND	KWH/YR REDUCTION SAVINGS	(KW)	1.675	2.109	0.123	11.910	15.817	4.675	0.246	0.111	5.032	0.825	2.740	3.585	4.515	2.600	0.246	0.200	7.561	8.160	9.600	0.150	17.910	3.925	2.132	6.057		0.150	0.150	7.920	7 020
-CULA		KWH/YR		10512.97	17005.95	928.2	25834.9	54282.0	29873.25	1890	911.25	32674.5	5178.03	5436.6	10614.63	75416.25	0	1856.4	1255.28	78527.9	30763.2	0.0	941.5	31704.7	25080.7	16380.0	41460.8		941.5	941.5	15200.6	15200 B
SCAL		TOTAL	(KW)	4.757	7.695	0.420	11.690		13.277	0.840	0.405		2.343	2.460	,	34.125	0.000	0.840	0.568		13.920	0.00	0.428		11.147	7.280			0.426		3.480	
VING	PROPOSED	IXTURE	(KW)	0.071	0.135	0.140	0.167		0.071	0.140	0.135		0.071	0.205		0.408	0.000	0.140	0.071		0.290	0.00	0.071		0.071	0.140			0.071		0.290	
r sa	PRO	TYPE		7	본	본	교		2	로	Ľ		4	Ī		¥		본	2		¥		d		4	4		LYZING	E		Ī	
ENERGY SAVINGS CALCULA HONS		KWH/YR # FIXTURES TYPE FIXTURE TOTAL		29	22	ຕຸ	2		187	60	m		8	12		84	0	•	∞		48	0	•		157	52		S - NOT ANALYZING	•		12	
		KWH/YR		14214.7	21666.8	1200.0	52156.0	89237.6	40392.0	2443.5	1161.0	43996.5	7001.3	11492.0	18493.28	85394.4	5746.0	2400.1	1697.3	95237.7	48796.8	21218.0	1273.0	71285.8	33912.0	21177.0	55089.0	100F FIXTURES	1273.0	1273.0	49795.2	49795.9
		TOTAL	(KW)	6.432	9.804	0.543	23.600		17.952	1.086	0.518		3.168	5.200		38.640	2.600	1.086	0.768		22.080	9.600	0.578		15.072	9.412		N-PROO	0.578		11.400	
	EXISTING		(KW)	0.096	0.172	0.181	0.200		960.0	0.181	0.172		0.096	0.200		0.460	0.200	0.181	960.0	-	0.460	0.200	0.096		960.0	0.181		EXPLOSION-PR	0.096		0.200	
	ũ	TYPE		4	ط	£	Z		2	4	료		교	ž		≩	Z	ď	ď		≩	Z	ď		4	ď		Z	귙		Z	
		BLDG. # HRS/YR # FIXTURES TYPE FIXTURE		29	57	m	118	,	187	°	°		33	28	:	84	13	0	co		48	48	₩		157	/ 52		92	80		57	
		# HRS/YR		2210	2210	2210	2210		2250	2250	2250		2210	2210		2210	2210	2210	2210		2210	2210	2210		2250	2250			2210		4368	
		BLDG.		1743					1751			\prod	1753			1790					1794			ţ	1830			1845			236	

KEY:

IN = INCANDESCENT
MV = MERCURY VAPOR
MM = METAL HALIDE FL = FLUORESCENT

WATTHUSEL

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

							•	
		LOCATION: Whit			REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	ECO #13 - P1	1751 – ENERGY EFFICIE	INT LIGHTING		FISCAL YEAR:	1992
		DISCRETE PORTIC	ON NAME:	TOTAL				
		ANALYSIS DATE:	03/18/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	INI	VESTMENT						
•		CONSTRUCTION	COST	-			\$5,842	
	В.	SIOH COST	0001	(5.5% of 1A) =			\$321	
		DESIGN COST		(6.0% of 1A) =			\$351	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$6,514	
				(124 154 10)=			\$0,514	
		SALVAGE VALUE	·	- (10, 40, -			 >	\$8,514
	r.	TOTAL INVESTME	IN I	(1D - 1E) =				40,514
2	EN	IERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	39	\$250	15.23	\$3,811	
	В.	DIST		0	\$0	17.28	. \$0	
	C.	NAT GAS	\$2.21	0	\$0	19.64	\$0	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		39	250.2		>	\$3,811
3	NC	N-ENERGY SAVIN	GS (+) / COST	(-)				
	A.	ANNUAL RECURP	ING (+/-) (ELE	C. DEMAND SAVINGS)	=		\$1,177	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	AVINGS (+) / C	COST (-)	(3A x 3A1) =		\$17,286	
	В.	NON-RECURRING	3 (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENE	RGY DISCOU	NTED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$17,286
	D.	PROJECT NON-E	NERGY TEST					
		1 25% MAXIMUM	NON-ENERG	Y CALCULATION		(2F5 x 0.33) =	\$1,258	
		a IF 3D1 => 3C	THEN GO TO 4	ļ				
		b IF 3D1 < 3C TI	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =	\$1	
		c IF 3D1b => 1 7	HEN GO TO 4			•		
		d IF 3D1b < 1 Th	HEN PROJECT	DOES NOT QUALIFY		•		
_								
		RST YEAR DOLLAR			(2F3	+ 3A + (3B1d/25)) =		\$1,428
		TAL NET DISCOUN				(2F5 + 3C) =		\$21,096
6				TMENT RATIO (SIR)		(5/1F) =		3.24
		F SIR < 1 THEN PRO		NOT QUALIFY)				
7	SI	MPLE PAYBACK (SF	'B)			(1F/4) =		4.56

WATTAISEA

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDC								۰
CONTRACTOR	R EMC ENGINEERS INC.		-	ADDRESS 2750 SOU	JTH WADSW	ORTH BLVI)., #C-200.	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	O 80227	
CONTRACT F	CONTRACT FOR (MOCK to be performed) ENERGY EFFICIENT LIGHTING IN BLDG, 1751	751					PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASER	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER	i :	WHITE SAN	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
				MATERIAL COST	L COST		LABOR COSTS			
Line	Item	Chit	Quantity			Manhours	Average		Other Direct	Line
Š.	Ξ	Measure (2)	8	<u>Ş</u> €	Total (5)	Mandays (6)	Rate	Total (8)	Costs	Total (10)
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT, ENERGY EFFICIENT LAMPS	EA	398	2.19	871.62	0.05	33.87	674.01		\$1,545.63
	8 FT, ENERGY EFFICIENT LAMPS	EA	6	5.12	30.72	0.05	33.87	10.16		\$40.88
	ENERGY EFFICIENT BALLASTS									
D5-6	2-LAMP (4') FIXTURE BALLAST	EA	199	14.06	2797.94	0.20	33.87	1348.03		\$4,145.97
8	2-LAMP (8') FIXTURE BALLAST	EA	က	29.68	89.04	0.20	33.87	20.32		\$109.36
;										
									•	
					·					
	TOTAL THIS SHEET									\$5,841.84
	Material Source: Lightbulb Supply Co., Denver, CO, Prices Include 25% Overhead & Profit; Labor	verhead & Profit; L	abor Source: Mea	ans Cost Data, 19	Source: Means Cost Data, 1992, Rates Include Overhead & Profit	rerhead & Profit				

WATTMISER

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION: Whit	e Sande Misell	e Range	REGION:	4	PROJECT NO:	DACA 63-01-C-0162
				1830 – ENERGY EFFICIE		•	FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				,,,,
		ANALYSIS DATE:	03/18/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IŃ۱	VESTMENT						
	A.	CONSTRUCTION	COST	=			\$7, 465	
	₿.	SIOH COST		(5.5% of 1A) =			\$411	
	C.			(6.0% of 1A) =			\$448	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$8,323	
		SALVAGE VALUE	·a 100	# ************************************			\$0	***
	۲,	TOTAL INVESTME	NT	(1D - 1E) =				\$8,323
2	EN	ERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	47	\$301	15.23	\$ 4,587	
	В.	DIST		0	\$0	17.28	\$0	
		NAT GAS	\$2.21	0	\$0	19.64	\$0	
		PAPER		0	\$0		\$0	
		COAL			\$0	16.22	\$0	
	F.	TOTAL		47	301.2		>	\$4,587
3	NO	N-ENERGY SAVIN	GS (+) / COST ((-)				
Ū				C. DEMAND SAVINGS)	_		\$1,417	
		1 DISCOUNT FAC			(From Table A-2) =	14.68	41,	
		2 DISCOUNTED S		:OST (-)	(3A x 3A1) =		\$20,807	
	В.	NON-RECURRING	i (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		C.		\$0		0.00	\$0	
	_	d TOTAL		\$0			\$0	
		PROJECT NON-E		ITED SAVINGS (+) / COS	51 (-)	(3A2 + 3Bd4) =		\$20,807
	U.	1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	61 514	
		a IF 3D1 => 3C 1				(2F5 x 0.33) =	\$1,514	
		b IF 3D1 < 3C Th				(2F5 + 3D1) / 1F =	\$1	
		c !F 3D1b => 1 T	HEN GO TO 4				••	
		d IF 3D1b < 1 TH	IEN PROJECT	DOES NOT QUALIFY			,	
Δ	FIE	RST YEAR DOLLAR	SAVINGS (4) (COSTS (-)	/oEo	+ 2A + (2D14/0E)\ =		#4 74A
		TAL NET DISCOUN			(2F3	+ 3A + (3B1d/25)) = (2F5 + 3C) =		\$1,719 \$25,202
				TMENT RATIO (SIR)		(2F5 + 3C) = (5/1F) =		\$25,393 3.05
-		SIR < 1 THEN PRO		• •		(SFIF) =		3.05
7		MPLE PAYBACK (SP				(1F/4) =		4.84
			•		, .	() –		₹•₩ 7

WATTAISER

			:							
	CONSTRUCTION COST ESTIMATE BREAKDOWN	: BREAKDC	N N							, ,
CONTRACTOR	EMS ENGINEERS INC			ADDRESS	TO CANAL THE		000			
CONTRACT	CONTRACT FOR (Work to be performed)			2/30/30(POSSO SOUTH WADSWORTH BLYD., #C-200, DENVER, CO 8022/	טאות פרעו	J., #C-ZUU,	J., #C-ZUU, DENVEH, C.	0 80227	
	ENERGY EFFICIENT LIGHTING IN BLDG. 1830	830					TIOLOSED IOIX	L CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	IDS MISSIFE	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	LCOST		LABOR COSTS			
Line	Item	# *	Quantity			Manhours	Average		Other	Line
Ö.	(1)	Measure (2)	9	F. 4	Total	Mandays	Rate	Total	Costs	Total
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS					2			9	6
	4 FT. ENERGY EFFICIENT LAMPS	EA	525	2.19	1143.18	0.05	33.87	884.01		\$2,027.19
	ENERGY EFFICIENT BALLASTS	Ē	261	14.06	3669.66	0.20	33.87	1768.01		\$5 437 67
D5-										
70										
	TOTAL THIS SHEET									\$7,464.86
	Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: Means Cost Data, 1992, Rates Include Overhead & Profit	erhead & Profit; La	bor Source: Mea	ns Cost Data, 19	92, Rates Include Ove	ithead & Profit				

LIGHTING

ENERGY SAVINGS CALCULATIONS

	-														
			_	EXISTING				፳	PROPOSED			DEMAND	ENERGY	ANNOAL	CONSTRUCTION
BLDG.	# HRS/YR	BLDG. # HRS/YR # FIXTURES TYPE FIXTURE	TYPE	FIXTURE	•	KWH/YR	KWH/YR # FIXTURES TYPE FIXTURE TOTAL KWH/YR REDUCTION SAVINGS	TYPE	FIXTURE	TOTAL	KWH/YR	REDUCTION	SAVINGS	ELECTRICAL	COST
			9	(KW)	(KW)				(KW	<u>§</u>		(KW)	(KWH)	COST SAVINGS	ESTIMATE
1751	2250	187/	4	960.0	17.952	40392.0	187	۳	0.058	10.846	24403.5	7.106	15988.5	\$2,016.15	
	2250	O O	교	0.181	1.086	2443.5	9	4	0.108	0.648	1458	0.438	985.5	\$124.27	
	2250	M	చ	0.172	0.516	1161.0	<u>ო</u>	굺	0.135	0.405	911.25	0.111	249.7	\$31.49	
						43996.5				•	26772.8	7.655	17223.8	\$2,171.91	\$8,400.92
1830	2250	\291	ار الا	960.0	15.072	33912.0	157	۳	0.058	9.108	20488.5	5.968	13423.5	\$1,692.70	
	2250	52	الو	0.181	9.412	21177.0	29	4	0.108	5.616	12636.0	3.798	8541.0	\$1,077.02	
						55089.0				•	33124.5	9.762	21964.5	\$2,769.72	\$10,743.02

FL = FLUORESCENT IN = INCANDESCENT MV = MERCURY VAPOR MH = METAL HALIDE

KEY:

41 FRED, ELECTRONIC BALLARTS

W PARE ENTH PHUSPHSALL AMPS.

HI TECH LIGHTING

		LOCATION: White		e Range 1751 – ENERGY EFFICIE	REGION: NT LIGHTING	4	PROJECT NO: FISCAL YEAR:	DACA 63-91-C-0152 1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/08/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
4	IMN	/ESTMENT						
•		CONSTRUCTION	COST				_\$8,401	7
		SIOH COST	000.	(5.5% of 1A) =			\$462	
		DESIGN COST		(6.0% of 1A) =			\$504	
		ENERGY CREDIT		(1A+1B+1C) =			\$9,367	
		SALVAGE VALUE					\$0	
		TOTAL INVESTME	ENT	(1D - 1E) =			>	\$9,367
2	EN	· ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	59	\$381	15.23	\$5,797	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	0	\$0	19.64	\$0	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16,22	\$0	
	F.	TOTAL		59	380.6		 >	\$ 5,797
3	NO	N-ENERGY SAVIN	GS (+) / COST	(-)				
	A.	ANNUAL RECURR	ING (+/-) (ELE	C. DEMAND SAVINGS)	-		\$1,177	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	AVINGS (+) / C	OST (-)	(3A x 3A1) =		\$17,286	
	В.	NON-RECURRING	3 (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
				ITED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$17,286
	D.	PROJECT NON-E				(255 - 25)		
		1 25% MAXIMUM				(2F5 x 0.33) =	\$1,913	
		a IF 3D1 => 3C T				(055 · 054) / 45 -	•4	
		b IF 3D1 < 3C Th		I E SIR		(2F5 + 3D1) / 1F =	\$1	
				DOES NOT QUALIFY				
		4 11 3D10 < 1 IF	LITT HOUSE	DOLUNOI GUNLIFI				
		ST YEAR DOLLAR		•	(2F3	+ 3A + (3B1d/25)) =	•	\$1,558
	_	TAL NET DISCOUN				(2F5 + 3C) =		\$23,083
6				IMENT RATIO (SIR)		(5/1F) =		2.46
-		SIR < 1 THEN PRO		IO I QUALIFY)		/4E/A		2.4
1	OIN	IPLE PAYBACK (SP	ره:			(1F/4) =		6.01

HG EN LIGHTING

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKD	NWC	 						
CONTRACTOR	¥			ADORESS						
	EMC ENGINEERS INC.			2750 SOL	JTH WADSW	ORTH BLV	D., #C-200,	2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	S 80227	
CONTRACT	CONTRACT FOR (Work to be performed) ENERGY EFFICIENT LIGHTING IN BLDG, 1751	751					PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WORKLOCATION WHITE SANDS MISSII F RANGE NEW MEXICO	BANGE NE	W MEXICO
				MATERIAL COST	L cost		LABORCOSTS			
Line	ltem	ē Ē	Quantity			Manhours	Average		Other	Line
Š	ε	Measure (2)	ව	Z €	Total (5)	Mandays (6)	Rate	Total (8)	Costs	Total (10)
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT, ENERGY EFFICIENT LAMPS	EA	398	3.00	1194	0.05	27.60	674.01		\$1,868.01
	8 FT, ENERGY EFFICIENT LAMPS	EA	9	5.90	35.40	90.0	28:88	10.16		845.56
	ENERGY EFFICIENT BALLASTS									
D5-7	2-LAMP (4') FIXTURE BALLAST	EA	199	25.00	4975.00	0.20	33,7.5	1348.03		\$6,323.03
3	2-LAMP (8') FIXTURE BALLAST	EA	3	48.00	144.00	0.20	27,63	20.32		\$164.32
									·	
				ŕ						
		·								
	TOTAL THIS SHEET									\$8,400.92
	Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: Means Cost Data, 1992, Rates Include Overhead & Profit	werhead & Profit; L	abor Source: Mea	ans Cost Data, 19	92, Rates Include Ov	erhead & Profit				

HIGH TECH LIGHTING.

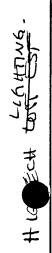
LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION ME		a.	250.01	•	PDG IEGT NG	
		LOCATION: White			REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				830 – ENERGY EFFICIE	NILIGHTING		FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/08/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
		1000110110						
1		/ESTMENT					A.a ===	
		CONSTRUCTION	COST	***			\$ 10,7 43	
		SIOH COST		(5.5% of 1A) =			\$591	
		DESIGN COST		(6.0% of 1A) =			\$845	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$11,978	
		SALVAGE VALUE		***			\$0	***
	F.	TOTAL INVESTME	INT	(1D - 1E) =			>	\$11,978
_	~. .							
2	EN	ERGY SAVINGS (+)			*******		510001111775	
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
		ELEC	\$6.48	75	\$485	15.23	\$7,393	
		DIST		0	\$0	17.28	\$0	
		NAT GAS	\$2.21	0	\$0	19.64	\$0	
		PAPER		0	\$0		\$0	
		COAL			\$0	16.22	\$0	
	F.	TOTAL		75	485.4		>	\$7,393
2	NO	N-ENERGY SAVIN	GR (A) LCORT (-	.				
3				. DEMAND SAVINGS)	_		\$1,417	
	л.	1 DISCOUNT FAC		. DEMAND SAVINGS)	(From Table A-2) =	14.68	41,417	
		2 DISCOUNTED S		NST (_)	(3A x 3A1) =	14.06	\$ 20.907	
		NON-RECURRING	• •	/31 (-)	(3A X 3A1) =		\$20,807	
	ь.	ITEM	· (+/-)		YEAR OF	DISCOUNT	DISCOUNTED	
		I I CIM		SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)		
		a.		\$0	OCCONNENCE (2)	0.00	SAVINGS (4)	
		b.		\$0		0.00	\$0 \$0	
		o.		\$0		0.00	\$0	
		d TOTAL		\$0		0.00	\$0	
	С		RGY DISCOUNT	ED SAVINGS (+) / COS	T(-)	(3A2 + 3Bd4) =	•	\$20,807
		PROJECT NON-EI		LD OATINGS (+)7 000	· (-)	(3/2 + 3004) =		\$20,007
	٥.	1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$2,440	
		a IF 3D1 => 3C T		OALOOLATION		(21 5 x 0.55) =	42,440	
		b IF 3D1 < 3C Th		E CID		(2F5 + 3D1) / 1F =	\$1	
		c IF 3D1b => 1 T		Lom		(255 + 301) / 15 =	••	
				OES NOT QUALIFY				
		G II-SDID € LIH	LI4 FROJECT D	OES NOT QUALIFY				
4	FIR	ST YEAR DOLLAR	SAVINGS (+) / C	OSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$1,903
		TAL NET DISCOUN		• •	, 5	(2F5 + 3C) =		\$28,199
6	DIS	COUNTED SAVING	S-TO-INVESTA	MENT RATIO (SIR)		(5/1F) =		2.35
		SIR < 1 THEN PRO				. (2)=		
-	011							

(1F/4) =

6.30

7 SIMPLE PAYBACK (SPB)



	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NMC							
CONTRACTOR				ADDRESS						
	EMC ENGINEERS INC.			2750 SOL	TH WADSW	ORTH BLVI	J., #C-200,	2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	0 80227	-
CONTRACT F	CONTRACT FOR (Work to be performed) ENERGY EFFICIENT LIGHTING IN BLDG. 1830	830					PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE R	PURCHASE REQUEST NUMBER			PROJECT NUMBER	SER		WHITE SAN	DS MISSILE	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	cost		LABORICOSTS			
Line	ltem	of Chil	Quantity			Manhours	Average		Other Direct	Line
o N	(E)	Measure (2)	ව	£ €	Total (5)	Mandays (6)	Rate	Total (8)	Costs (9)	Total (10)
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. T-8 LAMPS	EA	525	3.00	1566	0.05	27.60	884.01		\$2,450.01
	HIGH EFFICIECY ELECT. BALLASTS	EA	261	25.00	6525.00	0.20	27,60	1768.01		\$8,293.01
D5-7										
5										
		,								
	TOTAL THIS SHEET									\$10,743.02
	Material Source: Lightbulb Supply Co., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: Means Cost Data, 1992, Rates Include Overhead & Profit	without & Profit L	abor Source: Mea	ne Coet Deta, 19	32, Rates Include Ov	erhead & Profit				

		LOCATION: Whit	ta Sande Miceile	Panga	REGION:	4	PROJECT NO:	DAGA 60 04 C 04F0
				, nange .DG. 1550 – IR HEATER:		4	FISCAL YEAR:	DACA 63-91-C-0152 1992
		DISCRETE PORTI		TOTAL	•		TIOCAL TEAM.	1032
		ANALYSIS DATE:	06/11/92		ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER
						, ,		
1	IN۱	VESTMENT						
	A.	CONSTRUCTION	COST	=			\$10,313	
	В.	SIOH COST		(5.5% of 1A) =			\$567	
	C.	DESIGN COST		(6.0% of 1A) =			\$619	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$11,499	
	E.	SALVAGE VALUE		-			\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$ 11,49 9
2	EN	ERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
		ELEC	\$18.37	14	\$250	10.79	\$2,693	
		DIST NAT GAS	\$0.04	0	\$0	11.57	\$0	
		PAPER	\$2.21	127	\$281	12.38	\$3,479	
		COAL		0	\$0	11.05	\$0	
		TOTAL		141	\$0 530.7	11.35	\$0	\$ 0.170
	•	TOTAL		141	330.7		>	\$6,173
3	NO	N-ENERGY SAVIN	IGS (+) / COST ('-)				
				C. DEMAND SAVINGS)	=		\$0	
		1 DISCOUNT FAC		·	(From Table A-2) =	10.67	•	
		2 DISCOUNTED S	SAVINGS (+) / C	OST (-)	(3A x 3A1) =		\$0	
	B.	NON-RECURRING	G (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. EQUIP REPLAC	CEMENT COST	\$1,600	7	0.73	\$1,168	
		b.		\$0	0	0.00	\$0	
		c.		\$0	0	0.00	\$0	
	_	d TOTAL	_	\$1,600			\$1,168	
	_			TED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$1,168
	U.	PROJECT NON-E		(61) 6111 171611		42		-
		1 25% MAXIMUM				(2F5 x 0.33) =	\$2,037	
		a IF 3D1 => 3C 1 b IF 3D1 < 3C TI				(055 · 054) / 45 -		
		c IF 3D1b => 17		i E Sin		(2F5 + 3D1) / 1F =		
				DOES NOT QUALIFY				
				Zo worken !				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/15)) =		\$637
		TAL NET DISCOUN		• •	ζ	(2F5 + 3C) =		\$7,341
6	DIS	SCOUNTED SAVING	3S-TO-INVEST	MENT RATIO (SIR)		(5/1F) =		0.64
	(11	F SIR < 1 THEN PRO	OJECT DOES N	IOT QUALIFY)				
7	SIN	MPLE PAYBACK (SF	PB)			(1F/4) =		18.04

		LOCATION: White		Range DG. S1554 – IR HEATEI	REGION:	4	PROJECT NO: FISCAL YEAR:	DACA 63-91-C-0152 1992
		DISCRETE PORTI	ON NAME: 06/11/92	TOTAL	ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER
. 1	١N١	/ESTMENT						
	A.	CONSTRUCTION	COST	=			\$10,313	
	В.	SIOH COST		(5.5% of 1A) =			\$567	
	C.	DESIGN COST		(6.0% of 1A) =			\$619	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$11,499	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	ENT	(1D - 1E) =			>	\$11,499
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$18.37	14	\$250	10.79	\$2,693	
	В.	DIST		0	\$0	11.57	\$0	
	C.	NAT GAS	\$2.21	127	\$281	12.38	\$ 3,479	
	D.	PAPER		0	\$0		\$0	
		COAL			\$0	11.35	\$0	
	F.	TOTAL		141	530.7		>	\$6,173
3	NO	N-ENERGY SAVIN	(GS (+) / COST (-)				
Ū				C. DEMAND SAVINGS)			\$0	
		1 DISCOUNT FAC		,	(From Table A-2) =	10.67	•	
		2 DISCOUNTED S	SAVINGS (+) / C	OST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRING	G (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. EQUIP REPLAC	CEMENT COST	\$1,600	7	0.73	\$1,168	
		b.		\$0	0	0.00	\$0	
		C.		\$0	0	0.00	\$0	
	c	d TOTAL NON-ENE	BGA DISCOTIN	\$1,600 TED SAVINGS (+) / COS	PT (_)	(3A2 + 3Bd4) =	\$1,168	\$1 160
		PROJECT NON-E		TED SAVINGS (+) / COS	,, (-)	(SA2 + SBU4) =		\$1,168
		1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$2,037	
		a IF 3D1 => 3C			•	(=:::::::,	7-7	
		b IF 3D1 < 3C TI	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T	THEN GO TO 4					
		d IF 3D1b < 1 Th	HEN PROJECT	DOES NOT QUALIFY			•	
4	FIF	RST YEAR DOLLAR	SAVINGS (+) / (COSTS (-)	(2F3	+ 3A + (3B1d/15)) =		\$6 37
		TAL NET DISCOUN				(2F5 + 3C) =		\$7,341
6	DIS	SCOUNTED SAVING	3S-TO-INVEST	MENT RATIO (SIR)		(5/1F) =		0.64
	(IF	SIR < 1 THEN PRO	OJECT DOES N	OT QUALIFY)				
7	SIL	APLE PAYBACK (SF	PB)		•	(1F/4) =		18.04

		LOCATION: White	te Sands Missil	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	ECO #17 - BI	LDG. P1644 – IR HEATEI	RS		FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/11/92		ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER
1	IN۱	/ESTMENT						
	A.	CONSTRUCTION	COST	-			\$ 3,873	
	B.	SIOH COST		(5.5% of 1A) =			\$213	
	C.	DESIGN COST		(6.0% of 1A) =			\$232	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			. \$4,318	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$4,318
2	EN	ERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$18.37	5	\$98	10.79	\$1,059	
	В.	DIST		0	\$0	11.57	\$0	
	C.	NAT GAS	\$2.21	60	\$133	12.38	\$1,652	
	Ð.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	11.35	\$0	
	F.	TOTAL		66	231.6		 >	\$2,711
3	NO	N-ENERGY SAVIN	IGS (4) / COST	(-)				
·				C. DEMAND SAVINGS)	_		\$0	
		1 DISCOUNT FAC		o. Demand Carmido,	(From Table A-2) =	10.67	40	
		2 DISCOUNTED S		COST (-)	(3A x 3A1) =	10.07	\$0	
	В.	NON-RECURRING			(OTTA OTT)		40	
		ITEM	(- /		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. EQUIP REPLAC	CEMENT COST	* *	7	0.73	\$876	
		b.		\$0	0	0.00	\$0	
		C.		\$0	0	0.00	\$0	
		d TOTAL		\$1,200			\$876	
	C.	TOTAL NON-ENE	RGY DISCOUN	NTED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$876
	D.	PROJECT NON-E	NERGY TEST					
		1 25% MAXIMUM	NON-ENERGY	Y CALCULATION		(2F5 x 0.33) =	\$895	
		a IF 3D1 => 3C	THEN GO TO 4	,				
		b IF 3D1 < 3C TI	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b ≃> 1 T	THEN GO TO 4					
		d IF 3D1b < 1 Th	HEN PROJECT	DOES NOT QUALIFY				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/15)) =		\$312
5	то	TAL NET DISCOUN	ITED SAVINGS	3		(2F5 + 3C) =		\$3,587
6	DIS	SCOUNTED SAVING	3S-TO-INVES	TMENT RATIO (SIR)		(5/1F) =		0.83
	(II	F SIR < 1 THEN PRO	OJECT DOES 1	NOT QUALIFY)				
7	SIN	MPLE PAYBACK (SF	PB)			(1F/4) ≃		13.86

		LOCATION: White	te Sands Missil	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	ECO #17 - B	LDG. P1680 – IR HEATE	RS		FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/11/92		ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER
1	INV	VESTMENT						
	A.	CONSTRUCTION	COST	=			\$10,530	
	В.	SIOH COST		(5.5% of 1A) =			\$579	
	C.	DESIGN COST		(6.0% of 1A) =			\$632	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$11,741	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	:NT	(1D - 1E) =			>	\$11,741
						-		
2	EN	ERGY SAVINGS (+)	• • •					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$		DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
		ELEC	\$18.37	3	\$48	10.79	\$520	
		DIST		0	\$0	11.57	\$0	
		NAT GAS	\$2.21	239	\$529	12.38	\$6,548	
		PAPER		0	\$0		\$0	
		COAL			\$0	11.35	\$0	
	F.	TOTAL		242	577.1		>	\$7,068
3	NO	N-ENERGY SAVIN	GS (A) / COST	(_)				
ŭ				C. DEMAND SAVINGS)	_		\$0	
	• ••	1 DISCOUNT FAC	, , ,	o. Deminio Ontituo,	(From Table A-2) =	10.67	φυ	
		2 DISCOUNTED S		:OST (_)	(3A x 3A1) =	10.07	\$0	
	В.	NON-RECURRING	, ,		(0// 0//) -		Ψ0	
		ITEM	- (· · · /		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0	0	0.00	\$0	
		b.		\$0	0	0.00	\$0	
		c.		\$0	0	0.00	\$0	
		d TOTAL		\$0	· ·	0.00	\$0	
	C.		RGY DISCOUN	ITED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =	φυ	\$0
		PROJECT NON-EI			·· (-)	(3/2 + 3504) =		•••
		1 25% MAXIMUM		Y CALCULATION		(2F5 x 0.33) =	\$2,332	•
		a IF 3D1 => 3C T				(21 5 x 0.00) =	ψ2,552	
		b IF 3D1 < 3C TH				(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T				(21 0 + 3D I) / IF =		
				DOES NOT QUALIFY				
		IST YEAR DOLLAR		• •	(2F3	+ 3A + (3B1d/15)) =		\$577
		TAL NET DISCOUN				(2F5 + 3C) =		\$7,068
6				TMENT RATIO (SIR)		(5/1F) =		0.60
		SIR < 1 THEN PRO		IOT QUALIFY)				
7	SIN	IPLE PAYBACK (SP	B)			(1F/4) =		20.34

				_			•	
		LOCATION: White		•	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				DG. P1751 – IR HEATEI	7 S		FISCAL YEAR:	1992
		DISCRETE PORTIO		TOTAL				
		ANALYSIS DATE:	06/11/92		ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER
1	INI	/ESTMENT						
•		CONSTRUCTION	COST	_			\$10 E04	
		SIOH COST	0001	(5.5% of 1A) =			\$10,584 \$582	
		DESIGN COST		(6.0% of 1A) =			\$635	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$035 \$11,801	
		SALVAGE VALUE		(1/(1/15/10)=			\$11,001	
		TOTAL INVESTME	:NT	(1D – 1E) =			·	£11 001
	•			(10 10)			>	\$11,801
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$18.37	2	\$43	10.79	\$459	
	В.	DIST		0	\$0	11.57	\$0	
	C.	NAT GAS	\$2.21	221	\$490	12.38	\$6,060	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	11.35	\$0	
	F.	TOTAL		224	532.0		 >	\$6,519
					•			. ,
3	NO	N-ENERGY SAVIN	GS (+) / COST (-	-)				
	A.	ANNUAL RECURR	ING (+/-) (ELEC	. DEMAND SAVINGS)	=		\$0	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	10.67		
		2 DISCOUNTED S	AVINGS (+) / CO	OST (-)	(3A x 3A1) =		\$0	
	B.	NON-RECURRING	i (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. EQUIP REPLAC	EMENT COST	\$7 ,150	7	0.73	\$5,220	
		b.		\$0	0	0.00	\$0	
		c.		\$0	0	0.00	\$0	
		d TOTAL		\$7 ,150			\$5,220	
	C.	TOTAL NON-ENE	RGY DISCOUN	TED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$5,220
	D.	PROJECT NON-EI	NERGY TEST					
		1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$2,151	
		a IF 3D1 => 3C T						
		b IF 3D1 < 3C TH		E SIR		(2F5 + 3D1) / 1F =	0.73	
		c IF 3D1b => 1 T					•	
		d IF 3D1b < 1 TH	IEN PROJECT [DOES NOT QUALIFY				
4	FIR	ST YEAR DOLLAR	SAVINGS (+) / C	COSTS (-)	/252	+ 3A + (3B1d/15)) =		# 4 000
		TAL NET DISCOUN		,00.0()	(21-3			\$1,009
		COUNTED SAVING		MENT RATIO (SIR)		(2F5 + 3C) =		\$11,738
-		SIR < 1 THEN PRO				(5/1F) ≖		0.99
7		IPLE PAYBACK (SP				(1E/A) -		44 76
٠	J.,,•	(0)	-,			(1F/4) =		11.70

		LOCATION: Whit		_	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	ECO #17 - BL	DG. P1753 – IR HEATEI	48		FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/11/92		ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER
1	IN	VESTMENT						
	A.	CONSTRUCTION	COST	=			\$6,793	
	В.	SIOH COST		(5.5% of 1A) =			\$374	
	C.	DESIGN COST		(6.0% of 1A) =			\$408	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$7,575	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$7,575
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$18.37	1	\$23	10.79	\$250	
	₿.	DIST		0	\$0	11.57	\$0	
	C.	NAT GAS	\$2.21	90	\$198	12.38	\$2,452	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	11.35	\$0	
	F.	TOTAL		91	221.2		>	\$2,702
3	NO	N-ENERGY SAVIN	GS (+) / COST (-	-)				
	A.	ANNUAL RECURA	ING (+/-) (ELEC	DEMAND SAVINGS)			\$0	
		1 DISCOUNT FAC			(From Table A-2) =	10.67		
		2 DISCOUNTED S		OST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRING	≩ (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. EQUIP REPLAC	EMENT COST	\$4,550	7	0.73	\$3,322	
		b.		\$0	0	0.00	\$0	
		C.		\$0	0	0.00	\$0	
	_	d TOTAL		\$4,550	_		\$3,322	
				TED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$3,322
	D.	PROJECT NON-EI			•			
		1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$892	
		a IF 3D1 => 3C T						
		b IF 3D1 < 3C TH		ESIR		(2F5 + 3D1) / 1F =	0.47	
		c IF 3D1b => 1 T						
		d IF 3D1b < 1 TH	IEN PROJECT [OOES NOT QUALIFY				
,	-	OT VELD DOLL	041//11/06/					
		IST YEAR DOLLAR		JUS18 (-)	(2F3	+ 3A + (3B1d/15)) =		\$525
		TAL NET DISCOUN		HENT DATIC (CO)		(2F5 + 3C) =		\$6,023
0		COUNTED SAVING		• •		(5/1F) =		0.80
~	(117	SIR < 1 THEN PRO		JI QUALIFY)				

(1F/4) =

14.44

7 SIMPLE PAYBACK (SPB)

		LOCATION: Whi		•	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				DG. P1788 – IR HEATEI TOTAL	48		FISCAL YEAR:	1992
		DISCRETE PORTI	06/11/92	TOTAL	ECONOMIC LIEF.	45	DOCO 4 DED DV	1 0701/50
		ANALTSIS DATE:	00/11/92		ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER
1	IN۱	VESTMENT						
•		CONSTRUCTION	COST	_			\$5,677	
		SIOH COST		(5.5% of 1A) =			\$312	
		DESIGN COST		(6.0% of 1A) =			\$341	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$6,330	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$6,330
2	EN	ERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$18.37	1	\$26	10.79	\$279	
	8.	DIST		0	\$0	11.57	\$0	
	C.	NAT GAS	\$2.21	110	\$244	12.38	\$3,025	
		PAPER		0	\$0		\$0	
		COAL			\$0	11.35	\$0	
	F.	TOTAL		112	270.2		>	\$3,304
•	МО	N ENERGY CANAL	100 (.) (000± (•				
3		N-ENERGY SAVIN	•					
	Λ.	1 DISCOUNT FAC		C. DEMAND SAVINGS)	(From Toble 4.0)	10.07	\$0	
		2 DISCOUNTED S) QT (_)	(From Table A-2) =	10.67	••	
	В.	NON-RECURRING)31 (-)	(3A x 3A1) =		\$0	
		ITEM	- (/		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. EQUIP REPLAC	EMENT COST	\$5,200	7	0.73	\$3,796	
		b.		\$0	0	0.00	\$0	
		C.		\$0	0	0.00	\$0	
		d TOTAL		\$5,200			\$3,796	
	C.	TOTAL NON-ENE	RGY DISCOUNT	TED SAVINGS (+) / COS	FT (-)	(3A2 + 3Bd4) =		\$3,796
	D.	PROJECT NON-E	NERGY TEST					
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$1,090	
		a IF 3D1 => 3C	THEN GO TO 4					
		b IF 3D1 < 3C TI	HEN CALCULAT	ESIR		(2F5 + 3D1) / 1F =	0.69	
		c IF 3D1b => 1 7						•
		d IF 3D1b < 1 Th	HEN PROJECT [OOES NOT QUALIFY				
		OF VELD DALL (=	041/01/00 1 1 1 =					
		RST YEAR DOLLAR		50818 (-)	(2F3	+ 3A + (3B1d/15)) =		\$617
		TAL NET DISCOUN		MENT DATIO (OID)		(2F5 ÷ 3C) =		\$7,100
J		SCOUNTED SAVING F SIR < 1 THEN PRO				(5/1F) =		1.12
7		MPLE PAYBACK (SF		o, doner)		/1E/A\		40.00
•	J111	LL . A I DAOK (OF	- ,			(1F/4) =		10.26

		LOCATION. WE	ha Od- 1 <i>0</i> 21-	. D	55001			
		LOCATION: Whi		•	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		DISCRETE PORTI		.DG. P1794 – IR HEATEI	48		FISCAL YEAR:	1992
		ANALYSIS DATE:		TOTAL	EGGNONIO LIEE.	45	22224252	4 6701/57
		ANALTSIS DATE:	06/11/92		ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER
1	INV	VESTMENT						
•		CONSTRUCTION	COST	_			\$14,602	
		SIOH COST	0001	(5.5% of 1A) =			\$14,802	
		DESIGN COST		(6.0% of 1A) =			\$876	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$16,281	
		SALVAGE VALUE		(18 + 18 + 10) =			\$10,281	
		TOTAL INVESTME	:NT	(1D - 1E) -			·	\$10.004
	٠.	TOTAL INVESTIGE	-14 ((1D – 1E) =			>	\$16,281
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$18.37	5	\$100	10.79	\$1,084	
	В.	DIST		0	\$0	11,57	\$0	
	C.	NAT GAS	\$2.21	364	\$805	12.38	\$9,970	
	D.	PAPER			\$0		\$0	
	E.	COAL			\$0	11.35	\$0	
	F.	TOTAL		369	905.8		>	\$11,054
3	NO	N-ENERGY SAVIN	GS (+) / COST (-)				
	_			DEMAND SAVINGS)	=		\$0	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	10.67		
		2 DISCOUNTED S	AVINGS (+) / C	OST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRING	G (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. EQUIP REPLAC	EMENT COST	\$11,700	7	0.73	\$8,541	
		b.		\$0	0	0.00	\$0	
		c.		\$0	0	0.00	\$0	
		d TOTAL		\$11,700			\$8,541	
	C.	TOTAL NON-ENE	RGY DISCOUN	TED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$8,541
	D.	PROJECT NON-E	NERGY TEST					
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$3,648	
		a IF3D1 => 3C 7	THEN GO TO 4					
		b IF 3D1 < 3C TH	HEN CALCULAT	ESIR		(2F5 ÷ 3D1) / 1F =	0.90	
		c f*3D1b => 1 T	HEN GO TO 4			•	•	
		d IF 3D1b < 1 TH	IEN PROJECT (DOES NOT QUALIFY				
4	FIR	ST YEAR DOLLAR	SAVINGS (+) / (COSTS (-)	(2F3)	+ 3A + (3B1d/15)) =		\$ 1,68 6
		TAL NET DISCOUN		()	(2)	(2F5 + 3C) =		\$19,595
		COUNTED SAVING		MENT RATIO (SIR)		(5/1F) =		1.20
		SIR < 1 THEN PRO				(5) =		1.20
7		IPLE PAYBACK (SP		···		(1F/4) =		9.66
	-		•			(1177)**		8,00

		100171011 11111				_		
		LOCATION: Whit		_	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		DISCRETE PORTIO		.DG. P1827 – IR HEATEI	18		FISCAL YEAR:	1992
		ANALYSIS DATE:	06/11/92	TOTAL	ECONOMIC LIFE:	15	DDEDAGED BY.	A CTOVED
		ANALIGIO DAIL.	00/11/82		ECONOMIC LIFE.	15	PREPARED BY:	A. STOVER
1	IN۱	VESTMENT						
		CONSTRUCTION	COST	=			\$10,695	
		SIOH COST		(5.5% of 1A) =			\$588	
	C.	DESIGN COST		(6.0% of 1A) =			\$642	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$11,925	
	E.	SALVAGE VALUE		*			\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$11,925
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$18.37	1	\$19	10.79	\$203	
	В.	DIST		0	\$0	11.57	\$0	
	C.	NAT GAS	\$2.21	225	\$498	12.38	\$6,162	
		PAPER		0	\$0		\$0	
		COAL			\$0	11.35	\$0	
	F.	TOTAL		226	516.5		>	\$6,365
		TUTDOV 041011						
3		N-ENERGY SAVIN						
	Α.	1 DISCOUNT FAC		C. DEMAND SAVINGS)	(Francisch & A.A.)	40.00	\$0	
		2 DISCOUNTED S		OST (-)	(From Table A-2) =	10.67	••	
	R	NON-RECURRING		OO1 (-)	(3A x 3A1) =		\$0	
	-	ITEM	• (17-)		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. EQUIP REPLAC	EMENT COST		7	0.73	\$5,694	
		b.		\$0	0	0.00	\$0	
		c.		\$0	0	0.00	\$0	
		d TOTAL		\$7,800			\$5,694	
	C.	TOTAL NON-ENE	RGY DISCOUN	ITED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$5,694
		PROJECT NON-EI				,		
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$2,100	
		a IF 3D1 => 3C T	HEN GO TO 4					
		b IF 3D1 < 3C TH	IEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =	0.71	
	-	c IF 3D1b => 1 T	HEN GO TO 4					
		d IF3D1b<1TH	IEN PROJECT	DOES NOT QUALIFY				
4	FIR	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(959	+ 34 + (3R14/1E)) -	,	\$4 AA7
		TAL NET DISCOUN	, ,		(2F3	+ 3A + (3B1d/15)) = (2F5 + 3C) =		\$1,037 \$12,050
				TMENT RATIO (SIR)		(2F5 + 3C) = (5/1F) =		\$12,059 1.01
-		F SIR < 1 THEN PRO			•	(SFIF) =		1.01
7		APLE PAYBACK (SP		· · · · · · · · · · · · · · · · ·		(1F/4) =		11.50
-			•			(17/4) =		11.50

		LOCATION: Whit	te Sands Missile F	Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				G. P1833 – IR HEATEI	RS		FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME: T	OTAL				
		ANALYSIS DATE:	06/11/92		ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER
1	IN۱	VESTMENT						
	_	CONSTRUCTION	COST	=			\$8,268	
	В.			(5.5% of 1A) =			\$455	
		DESIGN COST		(6.0% of 1A) =			\$496	
		ENERGY CREDIT SALVAGE VALUE		(1A + 1B + 1C) =			\$9,219	
		TOTAL INVESTME	:NT	(1D - 1E) =			\$0	*0.040
	٠.	TOTAL INVESTME		(10 - 12) =			>	\$9,219
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$18.37	1	\$21	10.79	\$228	
		DIST		0	\$0	11.57	\$0	
		NAT GAS	\$2.21	116	\$257	12.38	\$3,178	
		PAPER COAL		0	\$0		\$0	
		TOTAL		117	\$0 277.8	11.35	\$0	\$2.400
	٠.	TOTAL		117	277.6		>	\$3,406
3	NO	N-ENERGY SAVIN	GS (+) / COST (-)					
	A.	ANNUAL RECURR	ING (+/-) (ELEC.	DEMAND SAVINGS)	=		\$0	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	10.67		
		2 DISCOUNTED S	AVINGS (+) / COS	ST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRING	à (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. EQUIP REPLAC	EMENT COST	\$5,850	7	0.73	\$4,271	
		b.		\$0	0	0.00	\$0	
		c. d TOTAL		\$0 \$5,850	0	0.00	\$0	
	C.		RGY DISCOUNTE	ED SAVINGS (+) / COS	T ()	(3A2 + 3Bd4) =	\$4,271	\$ 4,271
		PROJECT NON-EI			. ()	(6.2 : 654), =		44,271
		1 25% MAXIMUM	NON-ENERGY C	ALCULATION		(2F5 x 0.33) =	\$1,124	
		a IF 3D1 => 3C T	HEN GO TO 4					
		b IF 3D1 < 3C TH	IEN CALCULATE	SIR		(2F5 + 3D1) / 1F =	0.49	
		c IF 3D1b => 1 T	HEN GO TO 4					
		d IF 3D1b < 1 TH	IEN PROJECT DO	DES NOT QUALIFY				
4	FIR	ST YEAR DOLLAR	SAVINGS (+) / CC	STS (-)	(2F3	+ 3A + (3B1d/15)) =		\$668
5	TO	TAL NET DISCOUN	TED SAVINGS		-	(2F5 + 3C) =		\$7,677
6	DIS	SCOUNTED SAVING	IS-TO-INVESTM	ENT RATIO (SIR)		(5/1F) =		0.83
		SIR < 1 THEN PRO		CQUALIFY)				
7	SIM	IPLE PAYBACK (SP	B)			(1F/4) =		13.80

	CONSTRUCTION COST ESTIMATE BREAKDO	BREAKD	NWC							
CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SOL	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO	ORTH BLVI	J., #C-200,	DENVER, C	0 80227	
CONTRACT	CONTRACT FOR (Work to be performed) ECO #17 – INSTALL IR HEATERS IN HIGH BAY AREA	3AY AREA					PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	DS MISSILE	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	L COST		LABORICOSTS			
Line	Item	Unit of	Quantity			Manhours	Average		Other Direct	Line
Š	€	Measure (2)	ති	C Drit	Total (5)	Mandays (6)	Rate	Total (8)	Costs (9)	Total (10)
-	BUILDING 1680 INSTALL IR HEATING SYSTEM (CRV-E120)	EA	4	1620	6480	24	27.63	2652.48		\$9,132.48
	APPURTENANCES	ST	4	226	904	MATERIALS AND LABOR	AND LABOR			\$904.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	4			6.00	20.58	493.92		\$493.92
	TOTAL									\$10,530.40
N N	BUILDING 1751 INSTALL IR HEATING SYSTEM (CRV-E180)	EA	2	2400	4800	28	27.63	1547.28		\$6,347.28
	INSTALL IR HEATING SYSTEM (CRV-E120)	EA	1	1620	1620	24	27.63	663.12		\$2,283.12
	APPURTENANCES	ST	5	226	1130	MATERIALS	AND LABOR			\$1,130.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	10			4.00	20.58	823.2		\$823.20
	TOTAL									\$10,583.60
ဇ	BUILDING 1753 INSTALL IR HEATING SYSTEM (CRV-E180)	EA	1	2400	2400	28	27.63	773.64		\$3,173.64
	INSTALL IR HEATING SYSTEM (CRV-E120)	EA	1	1620	1620	24	27.63	663.12		\$2,283.12
	APPURTENANCES	S7	3	226	678	MATERIALS AND LABOR	AND LABOR			\$678.00
	DEMOLITION OF EXISTING UNIT HEATERS	E	8			4.00	20.58	658.56		\$658.56
	TOTAL									\$6,793.32
								·		
	Hoteld Courses Manne Classical & Machanical Cost Data 4009- Bohada Dadan Inc. Mas									

Material Source: Means Electrical & Mechanical Cost Data, 1992; Roberts-Gordon, Inc.; Material Prices Incloude 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1.

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NMC							
CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SOL	JTH WADSW	VORTH BLV	D., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO	0 80227	
CONTRACT	CONTRACT FOR (Work to be performed) ECO #17 - INSTALL IR HEATERS IN HIGH BAY AREA	BAY AREA					PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE R	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	NDS MISSILE	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	LCOST		LABORICOSTS			
Line	ltem	of Chit	Quantity			Manhours	Average		Other Direct	Fine
oʻ Z	£	Measure (2)	ල	<u>F</u> €	Total (5)	Mandays (6)	Rate	Total (8)	Costs (9)	Total (10)
4	BUILDING 1550 INSTALL IR HEATING SYSTEM (CRV-E360)	Æ	-	4346	4346		27.63	884.16		\$5,230.16
	APPURTENANCES	ST	4	226	904	MATERIALS AND LABOR	AND LABOR			\$904.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	4			4.00	20.58	329.28		\$329.28
	MAIN NATURAL GAS DISTRIBUTION PIPE	EA	-	3850	3850	MATERIALS	AND LABOR			\$3,850.00
	TOTAL									\$10,313.44
5	BUILDING 1554 INSTALL IR HEATING SYSTEM (CRV-E360)	EA	1	4346	4346	32	27.63	884.16		\$5,230.16
	APPURTENANCES	ST	4	226	904	MATERIALS AND LABOR	AND LABOR			\$904.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	4			4.00	20.58	329.28		\$329.28
	MAIN NATURAL GAS DISTRIBUTION PIPE	EA		3850	3850	MATERIALS	AND LABOR		,	\$3,850.00
	TOTAL									\$10,313.44
9	BUILDING 1644 INSTALL IR HEATING SYSTEM (CRV-E180)	EA	-	2400	2400	28	27.63	773.64		\$3,173.64
	APPURTENANCES	ST	2	226	452	MATERIALS AND LABOR	AND LABOR			\$452.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	က			4.00	20.58	246.96		\$246.96
	TOTAL					:				\$3,872.60
						:				

			•					:		
	CONSTRUCTION COST ESTIMATE BREAKD	: BREAKD(NMO							
CONTRACTOR	TOR EMC ENGINEERS INC.			ADDRESS 2750 SOI	JTH WADSW	ORTH BLV	D., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	J 80227	
CONTRAC	CONTRACT FOR (WORK to be performed) ECO #17 - INSTALL IR HEATERS IN HIGH BAY AREA	BAY AREA					PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASI	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
				MATERIAL COST	L COST		LABOR COSTS			
Line	ltem	Crit of	Quantity			Manhours	Average	i	Other Direct	Line
Š.	(1)	Measure (2)	ව	(4) (4)	Total (5)	Mandays (6)	Rate	Total (8)	Costs (9)	Total (10)
	BUILDING 1788 INSTALL IR HEATING SYSTEM (CRV-E120)	EA	2	1620	3240	24	27.63	1326.24		\$4,566.24
	APPURTENANCES	LS	2	226	452	MATERIALS AND LABOR	AND LABOR			\$452.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	8			4.00	20.58	658.56		\$658.56
	TOTAL									\$5,676.80
ρ ₆ 1:	BUILDING 1794 INSTALL IR HEATING SYSTEM (CRV-E240)	EA	2	2770	5540	30	27.63	1657.8		\$7,197.80
	INSTALL IR HEATING SYSTEM (CRV-E120)	EA	2	1620	3240	24	27.63	1326.24		\$4,566.24
	APPURTENANCES	rs	9	226	1356	MATERIALS AND LABOR	AND LABOR			\$1,356.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	18			4.00	20.58	1481.76		\$1,481.76
	TOTAL					:				\$14,601.80
6	BUILDING 1827 INSTALL IR HEATING SYSTEM (CRV-E120)	EA	4	1620	6480	54	27.63	2652.48		\$9,132.48
	APPURTENANCES	rs T	4	226	904	904 MATERIALS AND LABOR	AND LABOR			\$904.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	8			4.00	20.58	658.56		\$658.56
	TOTAL									\$10,695.04
	Material Source: Means Electrical & Mechanical Cost Data, 1982; Roberts-Gordon, Inc.; Material Prices Incloude 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1.	Bordon, Inc.; Mate	rial Prices Incloud	de 25% Overhea	d & Profit; Labor Sour	roe: U.S. Dept. of La	bor, General Wage (Decision No. NM91-1.		

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDC	NWO							
CONTRACTOR	ж EMC ENGINEERS INC.			ADDRESS 2750 SOL	JTH WADSW	ОВТН ВСУ	D., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO	D 80227	
CONTRACT F	CONTRACT FOR (Work to be performed) ECO #17 - INSTALL IR HEATERS IN HIGH BAY AREA	3AY AREA		,			PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE F	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BEA		WORKLOCATION WHITE SAN	IDS MISSILE	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	COST		LABOR COSTS			
Line	ltem	Cuit of tit	Quantity			Manhours	Average	,	Other Direct	Line
Ö.	€	Measure (2)	9	Unit	Total	Mandays (6)	Rate	Total	Costs	Total
10	BUILDING 1833 INSTALL IR HEATING SYSTEM (CRV-E120)	EA	3	1620	4860	24	27.63	1989.36		\$6,849.36
	APPURTENANCES	ST	3	226	678	MATERIALS AND LABOR	AND LABOR			\$678.00
	DEMOLITION OF EXISTING UNIT HEATERS	EA	6			4.00	20.58	740.88		\$740.88
	TOTAL				-					\$8,268.24
:										
				(
	Mate urce: Sierra Technical Products, Inc., Denver, CO; Prices Include 25% Overhead & Profit, Labor Source	25% Overhead 8	Profit, Labor Soc		s Coet Data, 1992, Rates Include Overhead & Profit	nclude Overhead &	Profit			

							٠			
	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NMC							
CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SOL	JTH WADSW	ORTH BLV	D., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	0 80227	
CONTRACT	CONTRACT FOR (WORK to be performed) ECO #17 – INSTALL IR HEATERS IN HIGH BAY AREA	3AY AREA					PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
				MATERIAL COST	COST		LABOR COSTS			
- i	Eq	Cuit	Organtity			Manhours	Average		Other	eri
Š ė		Measure	Commit	Cnit	Total	Mandays	Rate	Total	Costs	Total
	(1)	(2)	(3)	(4)	(2)	(9)	۵	(8)	(6)	(10)
	APPURTENANCES:									
	NATURAL GAS PIPING	4	10	1.38	13.80	0.131	35.81	46.91		\$60.71
	ELECTRICAL CONDUIT	F	30	5.50	165.00	MATERIALS AND LABOR	AND LABOR			\$165.00
	TOTAL									\$225.71
		:								
·										
		•								
	Material Source: Sierra Technical Products, Inc., Denver, CO, Prices Include 25% Overhead &	e 25% Overhead &	k Profit; Labor So	urce: Means Cost	Profit, Labor Source: Means Cost Data, 1992, Rates Include Overhead & Profit	clude Overhead &	Profit			

ESOS STUDY AT WSMR - BUILDING 1550
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO # 17)

Weather File Code:	ELPASO.W				
Location:					
Latitude:	31.0	(deg)			
Longitude:	106.0	(deg)			
Time Zone:	6				
Elevation:	3,918	(ft)			
Barometric Pressure:	25.8	(in. Hg)			
Summer Clearness Number:	1.00				
Winter Clearness Number:	1.00				
Summer Design Dry Bulb:	98	(F)			
Summer Design Wet Bulb:	64	(F)			
Winter Design Dry Bulb:	24	(F)			
Summer Ground Relectance:	0.20				
Winter Ground Relectance:	0.20				
Air Density:	0.0653	(Lbm/cuft)			
Air Specific Heat:	0.2444	(Btu/lbm/F)			
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)			
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)			
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)			

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:50:56 1/20/92 Dataset Name: 1550 .TM

Tstat = 65°

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- UNIT HEATERS Block Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Peaked at Time ==> OADB: 24 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: 0 Coil Peak Percnt * Space Peak Space Ret. Air Ret. Air Net Percnt Space Total Of Tot Of Tot * Space Sens Tot Sens Of Tot Sensible Sens.+Lat. Sensible Latent (%) * (Btuh) (Btub) Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) Skylite Solr 0 0.00 0 0.00 * 0 0 0.00 0.00 0.00 * 0 0 0.00 Skylite Cond 0.00 0 0.00 * -23,026 -23,026 6.85 Roof Cond 0 0 0 0.00 0 0.00 * 0 0 0.00 0 Glass Solar 0 0.00 * -174,939 -174.939 52.06 Glass Cond 0 0 ٥ 0.00 0 0.00 0 0.00 * -58,214 -58,214 17.32 Wall Cond 0 0.00 0 0.00 * 0 0.00 Partition 0 0.00 0 0.00 * -3,831 -3,831 1.14 Exposed Floor 0 0.00 * -76,052 -76,052 0.00 0 22.63 Infiltration 0.00 * -336,063 -336,063 100.00 Sub Total==> Internal Loads 0.00 * 0 0.00 Lights 0 0 ۵ 0.00 0 0 People 0 0 0.00 0 0.00 * 0 0 0.00 0.00 0 0.00 * 0 0 0.00 Misc 0 0 0 0.00 0 0.00 * 0.00 Sub Total ==> Ceiling Load 0 0 0 0.00 * 0 0.00 * 0 0 0.00 0.00 * Outside Air 0 0 0.00 * 0 0.00 0.00 * Sup. Fan Heat ٥ 0.00 * 0 0.00 0.00 * Ret. Fan Heat 0 0 0.00 * 0 0.00 0.00 * Duct Heat Pkup 0.00 * 0.00 * 0.00 * 0 OV/INDR Siging 0 0.00 * 0.00 * 0 Exhaust Beat 0 ٥ 0.00 * Terminal Bypass 0 0.00 * 0 0.00 a 0.00 0.00 * ~336,063 -336,063 100.00 Grand Total==> ------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (cfm) Deg F Deg F Grains Deg F Grains Floor 11,520 (Tons) Main Clg 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 ExFlr 125 Aux Clg 0.0 0.0 0.0 0.0 0.0 11.700 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Roof O Opt Vent 0.0 0 10,432 Totals 0.0 0.0 Wall 3,388 32 ------HEATING COIL SELECTION----------AIRFLOWS (cfm)-------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Type Cooling Heating Clg % OA 0.0 Type Clg Hta Lva (Mbh) (cfm) Deg F Vent. 0 0 Clg Cfm/Sqft 0.00 SADB 0.0 94.3 Deg F Main Htg -660.0 11,960 36.7 94.3 Infil 0 1.937 Clg Cfm/Ton 0.00 Plenum 0.0 65.0 Aux Htg 0.0 n 0.0 0.0 Supply 0 11,960 Clg Sqft/Ton 0.00 Return 0.0 65.0 0.0 0.0 0 Clg Btuh/Sqft 0.00 Ret/OA 0.0 Preheat 0.0 0 0.0 0.0 0.0 Return 11,960 No. People 0 Runarnd 0.0 65.0 Reheat 0.0 0.0 0 0 Htg % OA 0.0 0.0 Fn MtrTD 0.0 Humidif Exhaust 0.0 0 Htg Cfm/SqFt 0.0 0.0 0.0 Rm Exh 0 1.04 Fn BldTD Opt Vent 0.0 0.0 Total -660.0 Auxil 0 0 Htg Btuh/SqFt -57.29 Fn Frict 0.0

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HEATING LOADS AT COIL PEAK - ALTERNATIVE 1

BASELINE BUILDING 1550

AIRFLOW HEATING LOADS-------(At time of Coil Peak)

--- Ventilation -- --- Op. Vent.--- Reheat ---- Humidif. ----Airflow Sensible Airflow Sensible Airflow Sensible Airflow Latent Room Total (Btuh) (Cfm) Number Description (Cfm) (Btuh) (Cfm) (Btuh) (Cfm) (Btuh) 1 1ST FLOOR 0 0 0 0 0 0 0 0 1 Total/Ave. Zone 0 0 0 0 0 0 0 0 0 0 0 0 Zone 1 Block 0 0 0 0 0 0 0 0 0 0 0 System 1 Total/Ave. 0 0 0 0 0 0 ٥ 0 0 System 1 Block 0 0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1550

------ AIRFLOW HEAT GAIN AND LOSS ------ (At time of Coil Peak)

------ Beating ------Supply Return System Room System Run System Fan Fan Exhaust Exhaust Exhaust Ducted Plenum Around Corridr Return Heat Heat Loss Heat Total Airflow Airflow Airflow Airflow Airflow Airflow Room Number Description (Btuh) (Btuh) (Btuh) (Btuh) (Cfm) (Cfm) (Cfm) (Cfm) (Cfm) (Cfm) 1 1ST FLOOR 0 0 0 0 11,960 1 Total/Ave. Zone 0 0 0 0 0 0 0 0 0 0 11,960 1 Block 0 0 0 0 11,960 Zone 0 0 0 0 0 0 . о 0 1 Total/Ave. 0 System 0 0 0 0 0 0 0 11,960 0 0 1 Block 0 0 O System 0 0 0 0 0 11,960

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1550

----- BUILDING U-VALUES ------

----- Room U-Values -----Room Room (Btu/hr/sqft/F) Mass Capac. Summr Wintr Summr Wintr (1b/ (Btu/ Room Number Description Part. ExFlr Skylt Skylt Roof Windo Windo Wall Ceil. sqft) sqft/F) 1 1ST FLOOR 0.000 0.750 0.000 0.000 0.048 1.140 1.259 0.202 0.000 23.8 5.13 1 Total/Ave. 0.000 0.750 0.000 0.000 0.048 1.140 1.259 0.202 0.000 23.8 5.13 System 1 Total/Ave. 0.000 0.750 0.000 0.000 0.048 1.140 1.259 0.202 0.000 23.8 5.13 0.000 0.750 0.000 0.000 0.048 1.140 1.259 0.202 0.000 Building 23.8 5.13

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

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BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1550

------BUILDING AREAS ------

Room				er of icate	Floor Area/Dupl Room	Total Floor Area	Partition Area	Exposed Floor Area	Skylight Area	Skl /Rf	Net Roof Area	Window Area	Win /Wl	Net Wall Area
Number	Desci	iption	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(\$)	(sqft)	(sqft)	(%)	(sqft)
1	1ST F	LOOR	1	1	11,520	11,520	0	125	0	0	11,700	3,388	32	7,044
Zone	1	Total/Ave.				11,520	0	125	0	0	11,700	3,388	32	7,044
System	1	Total/Ave.				11,520	0	125	0	0	11,700	3,388	32	7,044
Buildin	g					11,520	0	125	0	0	11,700	3,388	32	7,044

initiation and a contraction

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

System Totals

Percent	Cool	ing Loa	ıd	Heatin	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-33,000	9	108	598.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-66,000	6	75	1,196.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-99,000	9	105	1,794.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-132,000	11	136	2,392.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-165,000	13	165	2,990.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-198,000	25	306	3,588.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-231,000	17	215	4,186.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-264,000	10	121	4,784.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-297,000	0	0	5,382.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-330,000	0	0	5,980.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-363,000	0	0	6,578.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-396,000	0	0	7,176.0	0	· o	0.0	0	0
60 - 65	0.0	0	0	-429,000	0	0	7,774.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-462,000	0	0	8,372.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-495,000	0	0	8,970.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-528,000	0	0	9,568.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-561,000	0	0	10,166.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-594,000	0	0	10,764.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-627,000	0	0	11,362.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-660,000	0	0	11,960.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,529	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------ MONTHLY ENERGY CONSUMPTION -----

	ELEC	DEMAND	GAS		GAS DMND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(kWh)	(kW)	(Therm)	(1000 Gl)	(Thrm/hr)
Jan	4,883	20	1,083	2	4
Feb	3,724	20	771	2	4
March	4,370	20	125	0	3
April	3,145	17	0	0	0
May	3,418	17	0	0	0
June	3,397	17	0	0	0
July	3,166	17	0	0	0
Aug	3,544	17	0	0	0
Sept	3,145	17	0	0	0
Oct	3,418	17	0	0	0
Nov	3,525	20	165	1	2
Dec	3,922	20	708	2	3
Total	43,657	20	2,851	7	4

Building Energy Consumption = 37,683 (Btu/Sq Ft/Year)
Source Energy Consumption = 38,449 (Btu/Sq Ft/Year)

Floor Area =

11,520 (Sq Ft)

engeböddek

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

Utility ELECTRIC DEMAND

Peak Value 19.8 (kW)

Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total 0.0 0.00

Heating Equipment

1	EQ200	2 GAS FIRE	TUBE STEAM	1	2.5	12.81
Sub T	otal				2.5	12.81
Sub T	otal				0.0	0.00
Sub T	otal				0.0	0.00

Miscellaneous

Lights	17.3	87.19
Base Utilities	0.0	0.00
Misc Equipment	0.0	0.00
Sub Total	17.3	87.19
Grand Total	19.8	100.00

ESOS STUDY AT WSMR - BUILDING 1550
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO). W
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)

•		
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(8tu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 4:53:15 1/21/92
Dataset Name: 1550 .TM

System 1 Block RAD - RADIATION

Peaked at T	ime ==>		Mo/Hr:	n/ n				MA	/Hr· '	י מעו	*	Ma/un.	13/ 1	
Outside Air			B/WB/HR:	0/ 0/ 0.	0		*		/Hr: NDB:	0/0	*	OADB:		
outside Aii		OND	0/ W0/ IIK.	0, 0, 0.	.0		*	0,	.	•	*	UAUB.	24	
		Space	Ret. Air	Ret. Air	Net	t Percn	· *	St	oace	Percnt	* Space 1	Peak Coi	l Peak	Percr
	Se	ns.+Lat.	Sensible		Total			Sensi		Of Tot	•		t Sens	Of To
Envelope Loa		(Btuh)	(8tuh)		(Btuh)				tuh)		•		(Btuh)	(7
Skylite So		0	0		(,,,	0		*	0	0	0.0
Skylite Co		0	0		(0	0.00	*	0	0	0.0
Roof Cond		0	0		(0.0	•		0	0.00	-20	,779 -	20,779	6.8
Glass Sola	ar	0	0		(0.00	* (0	0.00		0	. 0	0.0
Glass Cond	± t	0	0		(0.0	* (0	0.00	-157	.947 -1	57,947	52.0
Wall Cond		0	0		(0.00	*		0	0.00			52,535	17.3
Partition		0			(0.00	•		0	0.00		0	0	0.0
Exposed FI	oor	0			(0	0.00		458	-3,458	1.1
Infiltrati	ion	0			(0	0.00			68,633	22.6
Sub Total=		0	0		Č				0	0.00			03,352	100.0
Internal Loa		•	·			•	*		•		t	, , , , ,	05,552	100.0
Lights		0	0		c	0.00) *		0	0.00		0	0	0.0
People		0	•		Č				o	0.00		0	0	0.0
Misc		0	0	0	Č				0	0.00		0.	0	0.0
Sub Total=	:=>	0	0	0	ď				Ö	0.00		0	0	0.0
Ceiling Load		0	0	_	Ċ				Ō	0.00		0	0	0.0
Outside Air		0	0	0	C				0	0.00	•	0	0	0.0
Sup. Fan Hea	it				Ċ					0.00	•	•	0	0.0
Ret. Fan Hea	it		0		C	0.00	, *			0.00			0	0.0
Duct Heat Pk	cup		0		C	0.00	*			0.00	•		0	0.0
OV/UNDR Sizi	ng	0			0	0.00) *		0	0.00	•	0	0	
Exhaust Heat	:		0	0	0	0.00	*			0.00	•		0	0.0
Terminal Byp	ass		0	0	0	0.00	*			0.00	•		0	0.0
							*			•	•			
Grand Total=	:=>	0	0	0	O	0.00	*		0	0.00	-303,	352 -3	03,352	100.0
······································	otal C			ING COIL S								AREA		
	ons)	(Mbh)	(Mbh)	(cfm)		ng DB/WB g F Gra				WB/HR Grains	Gross To	11,520	lass (si	(%)
ain Clg	0.0	0.0	0.0	0	_	-	0.0	0.0	0.0	0.0	Part	0 0		
ux Cig	0.0	0.0	0.0	0			0.0	0.0	0.0	0.0	ExFlr	125		
ot Vent	0.0	0.0	0.0	0		0.0	0.0	0.0	0.0	0.0	Roof	11,700		0
otals	0.0	0.0	0.0	Ů	0.0	0.0	0.0	0.0	0.0	0.0	Wall	10,432	3,3	88 3
H	EATING	COIL SELEC	CTION		AI	RFLOWS (cfm)		E	NGINEERING	CHECKS	TFMPI	ERATURES	(F)
Ca	pacity	Coil Air	rfl Ent	Lvg	Туре	Cooling		Heating		% OA	0.0	Туре	Clg	Htg
	(Mbh)	(cfm) Deg F	Deg F	Vent	0		0	_	Cfm/Sqft	0.00	SADB	0.0	
ain Htg	-300.0		0.0	0.0	Infil	0		1,937		Cfm/Ton	0.00	Plenum	0.0	
ux Htg	0.0		0.0	0.0	Supply	0		0		Sqft/Ton	0.00	Return		
reheat	0.0		0.0	0.0	Mincfm	0		0		Btuh/Sqft		Ret/OA		
eheat	0.0		0.0	0.0	Return	0		0	-	People	0	Runarra		
midif	0.0		0.0	0.0	Exhaust	0		0		% OA	0.0	Fn Mtr		
ot Vent	0.0		0.0	0.0	Rm Exh	0		0		Cfm/SqFt	0.00	Fn Bld		
otal	-300.0				Auxil	0		0						0.

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HEATING LOADS AT COIL PEAK - ALTERNATIVE 2 INFRARED HEATERS - 1550

------ AIRFLOW HEATING LOADS ----- (At time of Coil Peak)

			Vent	ilation	Op.	Vent	Rel	heat	Kum	idif	
Room			Airflow	Sensible	Airflow	Sensible	Airflow	Sensible	Airflow	Latent	Total
Number		Description	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Btuh)
1	1ST F	LOOR	0	0	0	0	0	0	0	0	0
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1	Block	0	0	0	0	0	0	0	0	0
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0
System	1	Block	0	0	0	0	0	0	0	0	. 0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2 INFRARED HEATERS - 1550

(At time of Coil Peak)

			***************************************				- Heating	g	•				
			Supply	Return	System		System	Room			Run		System
			Fan	Fan	Exhaust		Exhaust	Exhaust	Ducted	Plenum	Around	Corridr	Return
Room			Heat	Heat	Heat Loss	Total	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow
Number	Į	Description	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)
1	1ST	FLOOR	0	0	0	0	0	0	0	0	0	0	0
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone	1	Block	0	0	0	0	0	0	0	0	0	0	0
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
System	1	Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 2 INFRARED HEATERS - 1550

35327274735

			Room U-Values(Btu/hr/sqft/F)									Room Mass	Room Capac.
Room					Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description		Part. Ex	Exflr	ExFlr Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST F	LOOR	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
Zone	1	Total/Ave.	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
System	1	Total/Ave.	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
Building	9		0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13

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BUILDING AREAS - ALTERNATIVE 2 INFRARED HEATERS - 1550

------ BUILDING AREAS ------

Room Number Descrip	Numbe Dupli ption Flr		Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	/Rf	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1 1ST FLO	OOR 1	1	11,520	11,520	0	125	0	0	11,700	3,388	32	7,044
Zone 1 1	Total/Ave.			11,520	0	125	0	0	11,700	3,388	32	7,044
System 1 1	Total/Ave.			11,520	0	125	0	0	11,700	3,388	32	7,044
Building				11,520	0	125	0	0	11,700	3,388	32	7,044

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SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

System Totals

Percent	Cooling Load		ad	Heati	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(8tuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-15,000	3	24	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-30,000	2	19	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-45,000	9	79	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-60,000	3	26	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-75,000	1	8	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-90,000	5	45	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-105,000	7	60	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-120,000	5	42	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-135,000	3	23	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-150,000	6	55	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-165,000	14	122	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-180,000	11	90	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-195,000	5	43	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-210,000	15	125	0.0	0	0	0,0	0	0
70 - 75	0.0	0	0	-225,000	11	93	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-240,000	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-255,000	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-270,000	0	0	0.0	0	0	0.0	0	0.
90 - 95	0.0	0	0	-285,000	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-300,000	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,906	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

-	M	0	N	Ţ	н	L	Y	Ε		1	E	R	G	Υ		С	0	N	S	U	М	Ρ	T	I	0	N	-
---	---	---	---	---	---	---	---	---	--	---	---	---	---	---	--	---	---	---	---	---	---	---	---	---	---	---	---

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	3,412	18	675	3
Feb	3,066	18	460	3
March	3,552	18	16	2
April	3,145	17	0	0
May	3,418	17	0	0
June	3,397	17	0	0
July	3,166	17	0	0
Aug	3,544	17	0	0
Sept	3,145	17	0	0
0ct	3,418	17	0	0
Nov	3,160	18	40	2
Dec	3,253	18	391	2
Total	39,676	18	1,581	3

Building Energy Consumption = Source Energy Consumption =

25,482 (Btu/Sq Ft/Year) 25,907 (Btu/Sq Ft/Year) Floor Area =

11,520 (Sq Ft)

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UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

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UTILITY	PEAK CHEC	: K S U M	s
Utility ELECTRIC DEMAND			
Peak Value 17.7 (kW) Yearly Time of Peak 9 (hr) 1 (mo)			
Hour 9 Month 1			
Sub Total	0.0	0.00	
Heating Equipment			
1 EQ2201 GAS FIRED UNIT HEATER	0.4	2.11	
Sub Total	0.4	2.11	
Sub Total	0.0	0.00	
Sub Total	0.0	0.00	
Miscellaneous			
Lights	17.3	97.89	
Base Utilities	0.0	0.00	
Misc Equipment	0.0	0.00	
Sub Total	17.3	97.89	
Grand Total	17.7	100.00	

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ESOS STUDY AT WSMR - BUILDING 155#
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO # 17)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) 1.00 Summer Clearness Number: Winter Clearness Number: 1.00 Summer Design Dry Bulb:

Winter Clearness Number: 1.00

Summer Design Dry Bulb: 98 (F)

Summer Design Wet Bulb: 64 (F)

Winter Design Dry Bulb: 24 (F)

Summer Ground Relectance: 0.20

Winter Ground Relectance: 0.20

annoising in

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:50:56 1/20/92
Dataset Name: 1554 .TM

Tstat = 65°

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Peaked at Time	Syste	em 1	Block	UH	- UNIT H	EATERS								
More	****	*****	******	COOLING COI	L PEAK ****	*****	*****	****** CI	G SPACE	PEAK ****	******	EATING COIL	PEAK	*****
Square S	Peake	d at Time									*			
Sens	Outsi	de A ir ==>	o	ADB/WB/HR:	0/ 0/ 0	.0		*	OADB:	0	*			
Sens			Space	Ret. Air	r Ret. Air	Ne:	t Percnt	*	Space	Percnt	* Snace	Peak Coil	Deak	Percet
Styling Condition Condit			-						_		•			
Skylite Solr	Envelo	ope Loads												
Skylite Cond		-						•			٠-	,		
Company Comp	_							*						
Class Solar 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	_							*	_					
Glass Cond Wall Cond O O O O O O O O O O O O O O O O O O O			0	c)	(*	_		*		-	
Nati			o	c)	Ċ		*			* -174			
Partition	Wall	l Cond	0	o)	C		*						
Exposed Floor 0			0					*						
Infiltration								*	-		*3			
Sub Total==>	=							*	-		_	-		
Internal Loads			-	0	.			*	_				-	
Lights			•	•		•	0.00	*	·	0.00		,003 -330	,,003	100.00
People			a	0		0			0	0.00	•	0		0.00
Hisc 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	_			·		_			_		•			
Sub Total==> 0 0 0 0 0 0 0.00 * 0 0.00 * 0 0.00 * 0 0.00 0.00 0 0.00 0 0 0.00 0 0 0.00 0 0 0.00 0 0 0 0.00 0 0 0 0.00 0 0 0 0.00 0 0 0 0.00 0 0 0 0.00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			-	0				*	_		1	-		
Cailing Load 0 0 0 0 0.00 * 0 0.00 * 0 0.00 * 0 0.00 Outside Air 0 0 0 0 0 0.00 * 0 0.00 * 0 0.00 * 0 0.00 Sup. Pan Heat 0 0 0.00 * 0.00 * 0 0.00 * 0 0.00 Ret. Pan Heat 0 0 0 0.00 * 0.00 * 0 0.00 Duct Heat Pkup 0 0 0 0 0.00 * 0.00 * 0 0.00 OV/UNDR Sizing 0 0 0 0.00 * 0.00 * 0 0.00 Exhaust Heat 0 0 0 0 0.00 * 0.00 * 0 0.00 Terminal Bypass 0 0 0 0 0.00 * 0.00 * 0 0.00 Grand Total ==> 0 0 0 0 0 0.00 * 0.00 * 0 0.00 Total Capacity Sens Cap. Coil Airfl Entring DB/WB/HR Leaving DB/WB/HR Gross Total Glass (ef) (%) Main Clg 0.0 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0			-					*	-	•		-	_	
Outside Air 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			-		-	_							-	
Sup. Fan Heat		•											-	
Ret. Fan Heat					,				-			•	-	
Duct Heat Pkup 0 0 0.00 * 0.00 * 0 0.00 * 0 0.00 COV/UNDR Sizing 0 0 0.00 * 0 0.00 * 0 0.00 * 0 0.00 COV/UNDR Sizing 0 0 0 0.00 * 0 0.00 * 0 0.00 * 0 0.00 COV/UNDR Sizing 0 0 0 0 0.00 * 0 0.00 * 0 0.00 * 0 0.00 * 0 0.00 * 0 0.00 * 0 0.00 * 0 0.00 * 0 0.00 COV/UNDR Sizing 0 0 0 0 0 0 0.00 * 0.00 * 0	-			o		0		ź			•			
COV/UNDR Sizing 0 0 0 0.00 * 0 0.00 * 0 0.00 * 0 0.00 Exhaust Heat 0 0 0 0 0.00 * 0.00 * 0.00 * 0 0.00 Terminal Bypass 0 0 0 0 0 0.00 * 0.00 * 0.00 * 0 0.00 Grand Total==> 0 0 0 0 0 0 0.00 * 0 0.00 * -336,063 -336,063 100.00 Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 11,520 Main Clg 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Duct H	eat Pkup		o		0		*			•		-	
Exhaust Heat 0 0 0 0 0.00 * 0.00 * 0.00 * 0 0.00 Terminal Bypass 0 0 0 0 0.00 * 0.00 * 0.00 * 0 0.00 Grand Total==> 0 0 0 0 0.00 * 0.00 * 0.00 * 0 0.00 Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (Cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 11,520 Aux Clg 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.		=	0			0		*	0		r	0	-	
Terminal Bypass 0 0 0 0 0.00 * 0.00 * 0.00 * 0 0.00 * 0 0.00 * 0 0.00 * 0 0.00 * 0 0.00 * 0 0.00 * 0 0.00 * 0 0 0.00 * 0 0 0.00 * 0 0 0.00 * 0 0 0.00 * 0 0 0.00 * 0 0 0.00 * 0 0 0 0		_		0	0	0		*	_			-		
Grand Total ==> 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0				0	0	0		*						
Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 11,520 Main Clg 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Aux Clg 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Totals 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Totals 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Totals 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Totals 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Totals 0.0 0.0 0.0 0.0 0.0 0.0 Totals 0.0 0.0 0.0 0.0 0.0 0.0 Totals 0.0 0.0 0.0 0.0 0.0 Totals 0.0 0.0 0.0 0.0 0.0 Totals 0.0 0.0 Totals 0.0 0.0 0.0 Totals 0.0								*		*			_	
Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (Cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 11,520 Main Clg 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Grand	Total==>	0	0	0	0	0.00	*	0	0.00 *	-336,	.063 -336	,063	100.00
Cons (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 11,520				coo	LING COIL S	ELECTION						Areas-		
Main Clg 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.				=			_		ving DE	B/WB/HR	Gross To	otal Gla	ss (sf	(\$)
Aux Clg 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.						_	=	•	-		Floor	11,520		
Opt Vent 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.		-												
Totals 0.0 0.0 0.0 Wall 10,432 3,386 32		-												
	-			0.0	0	0.0	0.0 0	.0 0.0	0.0	0.0				
Capacity Coil Airfl Ent Lvg Type Cooling Heating Clg % OA 0.0 Type Clg Htg (Mbh) (cfm) Deg F Deg F Vent 0 0 Clg Cfm/Sqft 0.00 SADB 0.0 94.3 Main Htg -660.0 11,960 36.7 94.3 Infil 0 1,937 Clg Cfm/Ton 0.00 Plenum 0.0 65.0 Aux Htg 0.0 0 0.0 Supply 0 11,960 Clg Sqft/Ton 0.00 Return 0.0 65.0 Preheat 0.0 0 0.0 Mincfm 0 0 Clg Etuh/Sqft 0.00 Ret/OA 0.0 65.0 Reheat 0.0 0 0.0 Return 0 11,960 No. People 0 Runarnd 0.0 65.0 Humidif 0.0 0 0 0 Exhaust 0 0 Htg Cfm/Sqft 1.04 Fn BldTD 0.0	TOTALS	0.0	0.0								Wall	10,432	3,3	88 32
(Mbh) (cfm) Deg F Deg F Vent 0 0 Clg Cfm/sqft 0.00 SADB 0.0 94.3 Main Htg -660.0 11,960 36.7 94.3 Infil 0 1,937 Clg Cfm/Ton 0.00 Plenum 0.0 65.0 Aux Htg 0.0 0 0.0 Supply 0 11,960 Clg Sqft/Ton 0.00 Return 0.0 65.0 Preheat 0.0 0 0.0 Mincfm 0 0 Clg Btuh/Sqft 0.00 Ret/OA 0.0 65.0 Reheat 0.0 0 0.0 Return 0 11,960 No. People 0 Runarnd 0.0 65.0 Humidif 0.0 0 0.0 Exhaust 0 0 Htg Cfm/Sqft 1.04 Fn BldTD 0.0 0.0		HEATI	NG COIL SEL	ECTION		AI	RFLOWS (c	fm)	E	NGINEERING	CHECKS	Temper	ATURES	(F)
(Mbh) (cfm) Deg F Deg F Vent 0 0 Clg Cfm/sqft 0.00 SADB 0.0 94.3 Main Htg -660.0 11,960 36.7 94.3 Infil 0 1,937 Clg Cfm/Ton 0.00 Plenum 0.0 65.0 Aux Htg 0.0 0 0.0 Supply 0 11,960 Clg Sqft/Ton 0.00 Return 0.0 65.0 Preheat 0.0 0 0.0 Mincfm 0 0 Clg Btuh/Sqft 0.00 Ret/OA 0.0 65.0 Reheat 0.0 0 0.0 Return 0 11,960 No. People 0 Runarnd 0.0 65.0 Humidif 0.0 0 0.0 Exhaust 0 0 Htg & OA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0 0.0 Rm Exh 0 0 Htg Cfm/SqFt 1.04 Fn BldTD 0.0 0.0 <		Capaci	ty Coil A	irfl Ent	Lvg	Туре	Cooling	Heating	Clg	% OA	0.0	Туре	Clg	Htg
Aux Htg 0.0 0 0.0 Supply 0 11,960 Clg Sqft/Ton 0.00 Return 0.0 65.0 Preheat 0.0 0 0.0 Mincfm 0 0 Clg Btuh/Sqft 0.00 Ret/OA 0.0 65.0 Reheat 0.0 0 0.0 Return 0 11,960 No. People 0 Runarnd 0.0 65.0 Humidif 0.0 0 0.0 Exhaust 0 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0 0.0 Rm Exh 0 0 Htg Cfm/Sqft 1.04 Fn BldTD 0.0 0.0		(Mbh) (cf:	m) Deg F	Deg F	Vent	0	0	Clg	Cfm/Sqft	0.00	SADB	0.0	94.3
Preheat 0.0 0 0.0 0.0 Mincfm 0 0 Clg Btuh/Sqft 0.00 Ret/OA 0.0 65.0 Reheat 0.0 0 0.0 0.0 Return 0 11,960 No. People 0 Runarnd 0.0 65.0 Humidif 0.0 0 0.0 Exhaust 0 Exhaust 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0 0.0 Rm Exh 0 0 Htg Cfm/Sqft 1.04 Fn BldTD 0.0 0.0	Main Ht	g -660	.0 11,	960 36.7	94.3	Infil	0	1,937	Clg	Cfm/Ton	0.00	Plenum	0.0	
Reheat 0.0 0 0.0 Return 0 11,960 No. People 0 Runarnd 0.0 65.0 Humidif 0.0 0.0 0.0 Exhaust 0 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0.0 0.0 Rm Exh 0 0 Htg Cfm/SqFt 1.04 Fn BldTD 0.0 0.0	Aux Ht	g 0	.0	0.0	0.0	Supply	0	11,960	Clg	Sqft/Ton	0.00	Return	0.0	65.0
Humidif 0.0 0 0.0 Exhaust 0 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0 0.0 Rm Exh 0 0 Htg Cfm/SqFt 1.04 Fn BldTD 0.0 0.0	Preheat	0	.0	0.0	0.0	Mincfm	0	0	Clg	Btuh/Sqft	0.00	Ret/OA	0.0	65.0
Opt Vent 0.0 0 0.0 0.0 Rm Exh 0 0 Htg Cfm/SqFt 1.04 Fn BldTD 0.0 0.0	Reheat	0	.0	0.0	0.0	Return	0	11,960	No.	People	0	Runarnd	0.0	65.0
T-1-1	Humidif	0	.0	0.0	0.0	Exhaust	0	0	Htg	% OA	0.0	Fn MtrTD	0.0	0.0
Total -660.0 Auxil 0 0 Htg Btuh/SqFt -57.29 Fn Frict 0.0 0.0	Opt Ven	t . 0	.0	0.0	0.0	Rm Exh	0	0	Htg	Cfm/SqFt	1.04	Fn BldTD	0.0	0.0
	Total	-660	.0			Auxil	0	0	Htg	Btuh/SqFt	-57.29	Fn Frict	0.0	0.0

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HEATING LOADS AT COIL PEAK - ALTERNATIVE 1
BASELINE BUILDING 1554

(At time of Coil Peak)

--- Ventilation -- --- Op. Vent.--- Reheat ---- Humidif. ---Room Sensible Airflow Sensible Airflow Sensible Airflow Latent Total Description (Cfm) (Btuh) (Cfm) (Btuh) (Cfm) (Btuh) (Cfm) (Btuh) (Btuh) 1 1ST FLOOR 0 0 0 0 0 0 0 0 1 Total/Ave. Zone 0 0 0 0 0 0 0 0 Zone 1 Block 0 0 0 0 0 0 0 ٥ 0 System 1 Total/Ave. 0 0 0 0 0 0 . 0 0 System 1 Block 0 0 0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1550

------ Heating ------Supply Return System System Room System Fan Pan Exhaust Exhaust Exhaust Ducted Plenum Around Corridr Return Room Heat Heat Heat Loss Total Airflow Airflow Airflow Airflow Airflow Airflow Airflow Number Description . (Btuh) (Btuh) (Btuh) (Btuh) (Cfm) (Cfm) (Cfm) (Cfm) (Cfm) (Cfm) 1 1ST FLOOR 0 0 Ω 0 0 0 0 0 11,960 1 Total/Ave. 0 0 0 0 0 0 0 0 0 0 11,960 Zone 1 Block 0 0 0 0 0 0 0 0 0 11,960 System 1 Total/Ave. 0 0 0 0 0 0 0 0 0 0 11,960 System 1 Block 0 0 O 0 11,960

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1550

distribute.

BUILDING U-VALUES-----

				Room Mass	Room Capac.								
Room					Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	umber Description		Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST F	LOOR	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
Zone	1	Total/Ave.	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
System	1	Total/Ave.	0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13
Building	3		0.000	0.750	0.000	0.000	0.048	1.140	1.259	0.202	0.000	23.8	5.13

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BUILDING AREAS - ALTERNATIVE 1

BASELINE BUILDING 1554

		Numb	er of	Floor Area/Dupl	Total Floor	Partition	Exposed Floor	Skylight	Skl	Net Roof	Window	Win	Net Wall
Room		Dupl	icate	Room	Area	Area	Area	Area	/Rf	Area	Area	/W1	Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	1ST FLOOR	1	1	11,520	11,520	0	125	0	0	11,700	3,388	32	7,044
Zone	1 Total/Ave.	_	_	55,555	11,520	0	125	0	0	11,700	3,388	32	7,044
System	1 Total/Ave.				11,520	0	125	0	0	11,700	3,388	32	7,044
Buildin	g				11,520	0	125	0	0	11,700	3,388	32	7,044

(**((ક્ષેત્ર**))

System Totals

Percent	Cool	ing Loa	ıd	Heatin	ng Load		Cooling	Airflow		Heating	Airflow	,
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-33,000	9	108	598.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-66,000	6	75	1,196.0	. 0	0	0.0	О	0
10 - 15	0.0	0	0	-99,000	9	105	1,794.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-132,000	11	136	2,392.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-165,000	13	165	2,990.0	0	0	0.0	o	0
25 - 30	0.0	0	0	-198,000	25	306	3,588.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-231,000	17	215	4,186.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-264,000	10	121	4,784.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-297,000	0	0	5,382.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-330,000	0	0	5,980.0	0	o	0.0	0	0
50 - 55	0.0	0	0	-363,000	0	0	6,578.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-396,000	0	0	7,176.0	0	. 0	0.0	0	0
60 - 65	0.0	G	0	-429,000	0	0	7,774.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-462,000	0	0	8,372.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-495,000	0	0	8,970.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-528,000	0	o	9,568.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-561,000	0	0	10,166.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-594,000	0	0	10,764.0	0	0	0.0	0	0
90 ~ 95	0.0	O	0	-627,000	О	0	11,362.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-660,000	0	0	11,960.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,529	0.0	0	0	0.0	0	8.760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------ MONTHLY ENERGY CONSUMPTION-----

	ELEC	DEMAND	GAS		GAS DMND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(kWh)	(kW)	(Therm)	(1000 G1)	(Thrm/hr)
Jan	4,883	20	1 003		
	•		1,083	2	4
Feb	3,724	20	771	2	4
March	4,370	20	125	o	3
April	3,145	17	0	0	0
May	3,418	17	0	0	0
June	3,397	17	0	0	0
July	3,166	17	0	0	0
Aug	3,544	17	0	0	0
Sept	3,145	17	0	0	0
Oct	3,418	17	0	0	0
Nov	3,525	20	165	1	2
Dec	3,922	20	708	2	3
Total	43,657	20	2,851	7	4

Building Energy Consumption = Source Energy Consumption =

37,683 (Btu/Sq Ft/Year) 38,449 (Btu/Sq Ft/Year)

Floor Area =

11,520 (Sq Ft)

occidental:

------UTILITY PEAK CHECKSUMS-----

Utility ELECTRIC DEMAND

Peak Value 19.8 (kW)

Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub Total 0.0 0.00

Heating Equipment

1		EQ2002	GAS	FIRE	TUBE	STEAM	2.5	12.81
Sub	Total						2.5	12.81
Sub	Total						0.0	0.00
Sub	Total						0.0	0.00

Miscellaneous

Lights	17.3	87.19
Base Utilities	0.0	0.00
Misc Equipment	0.0	0.00
Sub Total	17.3	87.19

Grand Total

19.8 100.00

D6-40

ESOS STUDY AT WSMR - BUILDING 1554
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 4:53:15 1/21/92
Dataset Name: 1554 .TM

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System Block RAD - RADIATION Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: Ω OADB: 24 Space Ret. Air Ret. Air Net Percnt Space Percnt * Space Peak Coil Peak Percnt Sens.+Lat. Sensible Latent Total Of Tot Sensible Of Tot * Space Sens Of Tot Tot Sens Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (%) * (Btuh) (Btuh) (Btuh) (%) Skylite Solr 0 0 n 0.00 * 0.00 * 0 0 0 0.00 Skylite Cond 0 0 0.00 * n 0 0.00 * 0 0 0.00 Roof Cond G Ω 0 0.00 * 0 0.00 * -20,779 -20,779 6.85 Glass Solar Λ Λ 0 0.00 * 0 0.00 0 0 0.00 Glass Cond 0 0 0 0.00 0.00 * 0 -157,947 -157,947 52.07 Wall Cond 0 0.00 0.00 * 0 -52,535 -52,535 17.32 Partition 0 O 0.00 0 0.00 0 0 0.00 Exposed Floor n 0 0.00 0 0.00 * -3,458 -3,458 1.14 Infiltration 0 0 0.00 O 0.00 * -68,633 -68,633 22.62 Sub Total ==> 0 0 n 0.00 0 0.00 * -303,352 -303,352 100.00 Internal Loads Lights 0 ٥ 0.00 0 0.00 * 0 0 0.00 People 0 0.00 0 0.00 * 0 0 0.00 Misc 0 0 0 0 0.00 0 0.00 * 0 Ω 0.00 Sub Total==> 0 0 0 0 0.00 0 0.00 * 0 0 0.00 Ceiling Load 0 0 0 0.00 0 0.00 * 0 0 0.00 Outside Air 0 0 0 0.00 0.00 * O 0.00 Sup. Fan Heat 0 0.00 0.00 * 0 0.00 Ret. Fan Heat 0 0 0.00 0.00 * 0 0.00 Duct Heat Pkup 0 O 0.00 * 0.00 * 0 0.00 OV/UNDR Sizing 0 0 0.00 0.00 * O 0 0. Exhaust Heat ٥ 0 0.00 0.00 * 0 0.00 Terminal Bypass 0.00 0.00 0 0.00 Grand Total ==> 0 0 0.00 * 0.00 * -303,352 -303,352 100.00 ------COOLING COIL SELECTION----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 11,520 Main Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Part 0 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 FxFir 125 Opt Vent 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0Roof 11,700 0 0 Totals 0.0 0.0 Wall 10,432 3,388 32 -----HEATING COIL SELECTION----------AIRFLOWS (cfm)------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Lvg Type Cooling Heating Clg % OA 0.0 Type Clg (Mbh) Deg F (cfm) Deg F Vent 0 0 Clg Cfm/Sqft 0.00 SADB 0.0 61.1 Main Htg -300.00.0 0 0.0 Infil n 1,937 Clg Cfm/Ton 0.00 Plenum 0.0 61.0 Aux Htg 0.0 0 0.0 0.0 Supply 0 0 Clg Sqft/Ton 0.00 Return 0.0 61.0 Preheat 0.0 0 0.0 0.0 Mincfm 0 Clg Btuh/Sqft 0.00 Ret/OA 0.0 61.0 Reheat 0.0 O 0.0 0.0 Return 0 0 No. People 0 Runarnd 0.0 61.0 **Humidif** 0.0 0.0 0.0 Exhaust 0 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0

Opt Vent

Total

0.0

-300.0

0.0

0.0

Rm Exh

Auxil

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0

0

Htg Cfm/SqFt

Htg Btuh/SqFt

0.00

-26.04

Fn BldTD

Fn Frict

0.0

0.0

0

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2 INFRARED HEATERS - 1554

AIRFLOW HEATING LOADS-----

(At time of Coil Peak)

--- Ventilation -- --- Op. Vent.--- Reheat ---- Humidif. ---Room Airflow Sensible Airflow Sensible Airflow Sensible Airflow Latent Total Number Description (Cfm) (Btuh) (Cfm) (Btuh) (Cfm) (Btuh) (Cfm) (Btuh) 1 1ST FLOOR 0 0 0 0 0 Ω 0 1 Total/Ave. Zone 0 0 0 0 0 n 0 0 Zone 1 Block 0 0 0 0 n 0 0 n System 1 Total/Ave. 0 0 0 0 0 0 0 0 System . 1 Block 0 Ω 0 ٥

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2 INFRARED HEATERS - 1550

AIRFLOW HEAT GAIN AND LOSS-----(At time of Coil Peak)

------ Heating ------Supply Return System System Room Fan Fan Exhaust Exhaust Exhaust Ducted Plenum Around Corridr Return Room Heat Heat Heat Loss Total Airflow Airflow Airflow Airflow Airflow Airflow Number Description (Btuh) (Btuh) (Btuh) (Btuh) (Cfm) (Cfm) (Cfm) (Cfm) (Cfm) 1 1ST FLOOR 0 0 0. 0 0 . 0 0 0 Ð ß 0 Zone 1 Total/Ave. 0 0 0 0 0 0 0 0 0 0 0 Zone 1 Block 0 0 0 0 0 0 0 n 0 System 1 Total/Ave. 0 0 0 0 0 ຄ 0 0 0 System 1 Block 0 0 0 n U 0 O

BUILDING U-VALUES - ALTERNATIVE 2
INFRARED HEATERS - 1550

BUILDING U-VALUES-----

Room U-Values -----Room Room (Btu/hr/sqft/F) Mass Capac. Room Summr Wintr Summr Wintr (lb/ (Btu/ Number Description Part. ExFlr Skylt Skylt Roof Windo Windo Wall Ceil. sqft) sqft/F) 1 1ST FLOOR 0.000 0.750 0.000 0.000 0.048 1.140 1.259 0.202 0.000 23.8 5.13 1 Total/Ave. 0.000 0.750 0.000 0.000 0.048 1.140 1.259 0.202 0.000 23.8 5.13 System 1 Total/Ave. 0.000 0.750 0.000 0.000 0.048 1.140 1.259 0.202 0.000 23.8 5.13 Building 0.000 0.750 0.000 0.000 0.048 1.140 1.259 0.202 0.000 23.8 5.13

BUILDING AREAS - ALTERNATIVE 2
INFRARED HEATERS - 1554

BUILDING AREAS -----

Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	/Rf	Net Roof Area (sqft)	Window Area (sqft)	Win /W((%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	11,520	11,520	0	125	0	0	11,700	3,388	32	7,044
Zone	1 Total/Ave.				11,520	0	125	0	0	11,700	3,388	32	7,044
System	1 Total/Ave.				11,520	0	125	0	0	11,700	3,388	32	7,044
Buildin	g				11,520	0	125	0	0	11,700	3,388	32	7,044

. આવેલાના સ્થા SYSTEM LOAD PROFILE -----

System Totals

Percent	Cool	ing Lo	ad	Heati	ng Load		Cooling	Airflo	H	Heating	Airflo	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-15,000	3	24	0.0	0	0	0.0	•	•
5 - 10	0.0	0	0	-30,000	2	19	0.0	0	0		0	0
10 - 15	0.0	o	Ō	-45,000	9	., 79	0.0	0	-	0.0	.0	0
15 - 20	0.0	0	o o	-60,000	3	26		•	0	0.0	0	0
20 - 25	0.0	0	0				0.0	0	0	0.0	0	0
	~~ 0.0	0		-75,000		8	0.0	0	0	0.0	0	0
		-	0	-90,000	5	45	0.0	0	0	0.0	0	0
	0.0	0	0	-105,000	7	60	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-120,000	5	42	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-135,000	3	23	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-150,000	6	55	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-165,000	14	122	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-180,000	11	90	0.0	0	. 0	0.0	o o	0
60 - 65	0.0	0	0	-195,000	5	43	0.0	0	o	0.0	0	0
65 - 70	0.0	0	0	-210,000	15	125	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-225,000	11	93	0.0	0	0	0.0	0	-
75 - 80	0.0	0	0	-240,000	0	0	0.0	0	0		-	0
80 - 85	0.0	0	0	-255,000	0	0	0.0	-	_	0.0	0	0
85 - 90	0.0	0	Ô	-270,000	_	-		0	0	0.0	0	0
90 - 95	0.0	0	-	-	0	0	0.0	0	0	0.0	0	0
95 - 100		•	0	-285,000	0	0	0.0	0	0	0.0	0	0
	0.0	0	0	-300,000	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,906	0.0	0	8,760	0.0	0	8,760

estate to the

------ MONTHLY ENERGY CONSUMPTION -----

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	3,412	18	675	3
Feb	3,066	18	460	3
March	3,552	18	16	2
April	3,145	17	0	0
May	3,418	17	0	0
June	3,397	17	0	0
July	3,166	17	0	0
Aug	3,544	17	0	0
Sept	3,145	17	0	0
0ct	3,418	17	0	0
Nov	3,160	18	40	2
Dec	3,253	18	391	2
lotal	39,676	18	1,581	3

Building Energy Consumption = Source Energy Consumption = 25,482 (Btu/Sq Ft/Year) 25,907 (Btu/Sq Ft/Year)

Floor Area ≖

11,520 (Sq Ft)

appropriate and the second sec

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

Grand Total

U T I L I T Y P	EAK CHEC	KSUMS-		
Utility ELECTRIC DEMAND				
Peak Value 17.7 (kW)				
Yearly Time of Peak 9 (hr) 1 (mo)	•			
Hour 9 Month 1				
Sub Total	0.0	0.00		
Heating Equipment				
1 EQ2201 GAS FIRED UNIT HEATER	0.4	2.11		
Sub Total	0.4	2.11		
Sub Total	0.0	0.00		
Sub Total	0.0	0.00		
Miscellaneous				
Lights	17.3	97.89		
Base Utilities	0.0	0.00		
Misc Equipment	0.0	0.00	_	
Sub Total	17.3	97.89		

17.7 100.00

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ESOS STUDY AT WSMR - BUILDING 1644
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO*17)
```

ELPASO.W

Location:		
Tatitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:		(in. Eg)
Summer Clearness Number:	1.00	

Weather File Code:

Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98 (I	")
Summer Design Wet Bulb:	64 (I	F)
Winter Design Dry Bulb:	24 (1	?)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
WILLER GLOGIS HELE		

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 9: 0:16 1/16/92 Dataset Name: 1644 .TM

By: Trane Customer Direct Service Network

System	1 3	Block	UH	- UNIT HE	ATERS									
******	*****	***** COC	LING COIL	PEAK ****	*****	*****				AK *****		NG COIL PEAR		****
Peaked at	Time ==>		Mo/Hr: ()/ 0			*	Mo/Hr		0 *	1	Mo/Hr: 13/ 1	<u>.</u>	
Outside Ai	ir ==>	OADI	B/WB/HR:	0/ 0/ 0.	0		*	OADB	: 0	*		OADB: 24		
					Wat	Dovant	*	Spac	•	* Percnt *	Space Peak	Coil Peal	c Po	ercnt
		Space	Ret. Air	Ret. Air		Percnt Of Tot	*	Sensibl		f Tot *	Space Sens			f Tot
		s.+Lat.	Sensible	Latent	Total	351 10	*	(Btuh		(%) *	(Btuh)	(Btuh		(%)
Envelope I		(Btuh)	(Btuh)	(Btuh)	(Btuh) O	0.00	*	•	0	0.00 *	0	•		0.00
Skylite		0	0		0	0.00	*		0	0.00 *	0		0	0.00
Skylite		0	0		0		*		0	0.00 *	-44,764		4	30.03
Roof Co		0	0		0				0	0.00 *	0	•	0	0.00
Glass S		0	0		0				0	0.00 *	C		0	0.00
Glass C		0	0		0				0	0.00 *	-50,528	-50,52	8	33.89
Wall Co		0	0		0				0	0.00 *	d		0	0.00
Partiti		0			0				0	0.00 *	-9,594	-9,59	4	6.44
Exposed		0			0				0	0.00 *	-54,648	•		36.66
Infiltr		0	_		0				0	0.00 *	-159,534			.07.02
Sub Tot		0	0			0.00			•	*	200,00	,		
Internal	Loads	_	_		c	0.00			0	0.00 *	()	0	0.00
Lights		0	0						0	0.00 *			0	0.00
People		0	_						0	0.00 *			0	0.00
Misc		0	Q.		(0	0.00 *		·)	0	0.00
Sub Tot	al==>	0	0		,				0	0.00 *)	0	0.00
Ceiling L		0	C.						0	0.00 *	*	9	0	0.00
Outside A		0	ď	0	(•	0.00 *		1,01	.3	-0.68
Sup. Fan	Eeat		_		(0.00				0.00 *			0	0.00
Ret. Fan	Heat		(0.00 *			0	0.00
Duct Heat	-	_	()		0.00			0	0.00 *	9,44	5 9,44	15	-6.34
OV/UNDR S	Sizing	0				0.00			Ū	0.00 *	-,	,	0	0.00
Exhaust E			(0.00				0.00 *			0	0.00
Terminal	Bypass		,) 0	,	0.00	*			*				
Grand Tot	1>	٥		, 0		0.00) *		0	0.00 *	-150,08	9 -149,0	76	100.00
Grand 10	Lai>	Ū												
			co	oLING COIL	SELECTION							areas		
	Total C		Sens Cap.	Coil Airf		ing DB/W			ng DB/		Gross Tota	l Glass	(sf)	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)			ains	Deg F D	eg P	Grains	Floor	5,459		
Main Clg	0.0	0.0	0.0	` ,	_	0.0	0.0	0.0	0.0	0.0	Part	0		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	312		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	5,459		0 0
Totals	0.0	0.0									Wall	5,604		0 0
100010					·									
	HEATING	COIL SEL	ECTION		A	IRFLOWS	(cfm)		El	GINEERING	CHECKS	TEMPERAT		
	Capacity				Туре	Coolin	g	Heating	Clg	% OA	0.0		Clg	Htg
	(Mbh)	(cf	m) Deg	F Deg F	Vent		0	0	Clg	Cfm/Sqft	0.00	SADB		120.0
Main Htg	-90.0	2,	850 87.	0 120.0	Infil		o .	1,392	Clg	Cfm/Ton	0.00	Plenum	0.0	65.0
Aux Htg	0.0	· ·	0 0.	0.0	Supply		0	2,850	-	Sqft/Ton	0.00	Return	0.0	65.0
Preheat	0.0)	0 0.	0.0	Mincfm		0	0	Clg	Btuh/Sqf		Ret/OA	0.0	65.0
Reheat	0.0	· ·	0 0.	0.0	Return		0	2,850		People	0	Runarnd	0.0	65.0
Humidif	0.0	0	0 0	0.0	Exhaust		0	0	-	% OA	0.0	Fn MtrTD	0.0	0.1
Opt Vent	0.0	0	0 0.	0.0	Rm Exh		0	0	Htg	Cfm/SqFt		Fn BldTD	0.0	0.1
Total	-90.	0			Auxil		0	0	Htg	Btuh/SqF	t -16.49	Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1 BASELINE BUILDING 1644

(At time of Coil Peak)

		Vent:	ilation	Op.	Vent	Re	heat	Hum	idif	
Room		Airflow	Sensible		Sensible		Sensible	Airflow	Latent	Total
Number	Description	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Btuh)
MUMDEL	1ST FLOOR	0		0	0	0	0	0	0	0
1		0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	-	0	0	0	0	0	0	0
Zone	1 Block	0	0		_		0	0	0	0
System	1 Total/Ave.	0	0	0	0	_	-		0	0
System	1 Block	0	0	0	0	0	0	0	U	·

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1644

(At time of Coil Peak)

						- Heating	g						
,		S	Return	System		System	Room			Run		System	
		Supply	Fan	Exhaust		-	Exhaust	Ducted	Plenum	Around	Corridr	Return	
		Fan		Heat Loss	Total				Airflow	Airflow	Airflow	Airflow	
Room		Heat	Heat	(Btuh)	(Btuh)	(Cfm)		(Cfm)	(Cfm)		(Cfm)		
Number	Description	(Btuh)	(Btuh)	(Bean)	(200)	(,	(· ,	, ,					
				0	1,013	o	0	0	0	. 0	0	2,850	
1	1ST FLOOR	1,013	0		•	0		0	0	0	0	2,850	
Zone	1 Total/Ave.	1,013	0	0	1,013			_			0	2,850	
Zone	1 Block	1,013	0	0	1,013	0	0	0	0	U		•	
Zone		•	0	0	1,013	0	0	0	0	0	. 0	2,850	
System	<pre>1 Total/Ave.</pre>	1,013			•		. 0	0	o) 0	. 0	2,850	
System	1 Block	1,013	0	0	1,013	0	, ,	•			_	•	

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1644

BUILDING U-VALUES-----

		Room U-Values(Btu/hr/sqft/F)											Room Capac.
Room					Summr	Wintr		Summr	Wintr			(1b/	(Btu/
Number	Desc	ription	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST F	LOOR	0.000	0.750	0.000	0.000	0.200	0.000	0.000	0.220	0.000	71.8	15.25
Zone		Total/Ave.	0.000	0.750	0.000	0.000	0.200	0.000	0.000	0.220	0.000	71.8	15.25
	1			0.750	0.000	0.000	0.200	0.000	0.000	0.220	0.000	71.8	15.25
System Buildin	-	10021/11/01	0.000	0.750	0.000	0.000	0.200	0.000	0.000	0.220	0.000	71.8	15.25

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1644

BUILDING AREAS -----

Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Sk1 /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	1ST FLOOR	1	1	5,459	5,459	0	312	0	0	5,459	0	0	5,604
Zоле	1 Total/Ave	_	_		5,459	0	312	0	0	5,459	0	0	5,604
System	1 Total/Ave				5,459	0	312	0	0	5,459	0	0	5,604
Buildin		-			5,459	0	312	0	0	5,459	0	0	5,604

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

SYSTEM LOAD PROFILE -----

System Totals

Parcent	Cool	ing Loa	d	Heatin	ig Load -		Cooling	Airflow		 Heating		
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-4,500	6	96	142.5	0	0	0.0	0	0
5 - 10	0.0	0	0	-9,000	6	100	285.0	0	0	0.0	0	0
10 - 15	0.0	0	0	~13,500	2	28	427.5	0	0	0.0	0	0
15 - 20	0.0	0	0	-18,000	4	75	570.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-22,500	2	43	712.5	0	0	0.0	0	0
25 - 30	0.0	٥	0	-27,000	4	55	855.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-31,500	3	50	997.5	0	0	0.0	0	0
35 - 40	0.0	0	0	-36,000	1	19	1,140.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-40,500	4	75	1,282.5	0	0	0.0	0	0
45 - 50	0.0	0	0	-45,000	5	86	1,425.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-49,500	3	57	1,567.5	0	0	0.0	0	0
55 - 60	0.0	0	0	-54,000	4	66	1,710.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-58,500	9	160	1,852.5	0	0	0.0	0	0
65 - 70	0.0	0	0	-63,000	6	100	1,995.0	0	0	0.0	0	0
70 - 75	0.0	0	. 0	-67,500	6	103	2,137.5	O	. 0	0.0	0	0
75 - 80	0.0	0	0	-72,000	7	128	2,280.0	0	0	0.0	0	o
80 - 85	0.0	0	0	-76,500	9	152	2,422.5	0	0	0.0	0	0
85 - 90	0.0	0	o	-81,000	4	74	2,565.0	0	0	0.0	0	0
90 - 95	0.0	0		-85,500	3	59	2,707.5	0	0	0.0	0	0
95 - 100	0.0	0		-90,000	11	185	2,850.0	100	8,760	0.0	0	0
Hours Off	0.0	0		0	0	7,038	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

	ELEC	DEMAND	GAS	GAS DMIND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	2,591	12	508	1
Feb	2,336	12	370	1
March	2,282	12	65	1
April	1,908	10	O	0
May	2,073	10	0	0
June	2,061	10	0	0
July	1,920	10	0	0
Aug	2,150	10	0	0
Sept	1,908	10	0	0
Oct	2,073	10	0	0
Nov	2,055	12	79	1
	2,402	12	342	1
Dec Total	25,758	12	1,364	1

Building Energy Consumption = Source Energy Consumption =

41,097 (Btu/Sq Ft/Year)

41,870 (Btu/Sq Ft/Year)

Floor Area = 5,459 (Sq Ft)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

Grand Total

------UTILITY PEAK CHECKSUMS-----

UTILITY PEAK	CHECK	5 0 M 5
Utility ELECTRIC DEMAND		
Peak Value 11.5 (kW) Yearly Time of Peak 9 (hr) 1 (mo)		
Hour 9 Month 1		
Sub Total	0.0	0.00
Heating Equipment		
1 EQ2002 GAS FIRE TUBE STEAM	1.0	8.88
Sub Total	1.0	8.88
Sub Total	0.0	0.00
Sub Total	0.0	0.00
Miscellaneous		
	10.5	91.12
Lights Base Utilities	0.0	0.00
Misc Equipment	0.0	0.00
MISC Equipment Sub Total	10.5	91.12

11.5 100.00

ESOS STUDY AT WSMR - BUILDING 1644
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Weather File Code: ELPASO.W Location: 31.0 (deg) Latitude: 106.0 (deg) Longitude: Time Zone: Elevation: 3,918 (ft) 25.8 (in. Hg) Barometric Pressure: Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) 64 (F) Summer Design Wet Bulb: Winter Design Dry Bulb: 24 (F) 0.20 Summer Ground Relectance: Winter Ground Relectance: 0.20 0.0653 (Lbm/cuft) Air Density:

Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 3:11:17 1/21/92
Dataset Name: 1644 .TM

V 600 PAGE

System 1 Block RAD - RADIATION

System	, ,	LOCK	KAU	N/D III 10	.,							V		
*****	*****	**** CO	OLING COIL	PEAK *****	*****	****	****	*** CLG 9	SPACE PE	AK *****	***** HEATI)	IG COIL PEA	K ****	****
Peaked at				0/ 0			*	Mo/H				10/Hr: 13/	1	
Outside A	ir ==>	OADI	B/WB/HR:	0/ 0/ 0.0			*	OAD	DB: 0	*		OADB: 24		
		_		B	N - 4	. D		Sn.		Percnt *	Space Peak	Coil Pea	ak P	ercnt
		Space	Ret. Air			Percn Of To		Sensil	ace hle (of Tot *	Space Sens	Tot Ser		f Tot
		.+Lat.	Sensible		Total (Btuh)		•	(Bti		(%) *	(Btuh)	(Btul		(%)
Envelope !		(Btuh)	(Btuh) O		(8001)			(50.	0	0.00 *	0	•	0	0.00
Skylite		0 0	0		0				0	0.00 *	0		0	0.00
Skylite		0	0		Ċ				0	0.00 *	-40,397		97	28.06
Roof Co		0	0		Ċ				0	0.00 *	0	•	0	0.00
Glass S		0	0		Č		0 *		0	0.00 *	0		0	0.00
Glass C		0	0		·		0 *		Ō	0.00 *	-45,598	-45,5	98	31.67
Wall Co		0	U		ì		0 *		0	0.00 *	0		0	0.00
Partiti		0			ì		0 *		0	0.00 *	-8,658	-8,6	58	6.01
Exposed		0			. (0 *		0	0.00 *	-49,317			34.26
Infiltr		0	0	r		0.0			0	0.00 *	-143,970			100.00
Sub Tot		U	U		`		*		•	*				
Internal	Loads	0	0	i	(0.0	n *		0	0.00 *	o		0	0.00
Lights		0	·				0 *		0	0.00 *	0	1	0	0.00
People Misc		0	0	0			00 *		0	0.00 *	C	;	0	0.00
Sub Tot	·al==>	0	0				0 *		0	0.00 *	c)	0	0.00
Ceiling L		0	C			0 0.0			0	0.00 *	c)	0	0.00
Outside A		0	Ċ			0 0.0			0	0.00 *	·)	0	0.00
Sup. Fan		·		,			00 *			0.00 *			0	
Ret. Fan			c)		0 0.0				0.00 *			0	
Duct Heat			Ċ)		0 0.0	00 *			0.00 *			0	0.00
OV/UNDR S	•	0				0 0.0	00 *		0	0.00 *	()	0	0.00
Exhaust H	-	-	(0		0 0.	00 *			0.00 *			0	0.00
Terminal			(0		0 0.	00 *			0.00 *			0	0.00
	••						*			*				
Grand Tot	tal==>	0	(0		0 0.	00 *		0	0.00 *	-143,970	-143,9	770	100.00
			r	OLING COIL S	ELECTION							AREAS		
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Total Ca	nacity	Sens Cap.	Coil Airfl		ing DB/	WB/HR	Leav	ving DB/	/WB/HR	Gross Tota	l Glass	s (sf)	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)		eg F G					Floor !	5,459		
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Part	0		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Exflr	312		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	5,459		0 0
Totals	0.0	0.0									Wall	5,604		0 0
	HEATING	COIL SEL	ECTION			AIRFLOWS	(cfm)		E)	NGINEERING	CHECKS	TEMPERA	TURES	(F)
	Capacity				Type	Cooli	ng	Heating	Clg	% OA	0.0	Type	Clg	Htg
	(Mbh)	(cf	m) Deg	F Deg F	Vent		0	0	Clg	Cfm/Sqft	0.00	SADB	0.0	61.1
Main Htg	-120.0	•	0 0.	-	Infil		0	1,392	Clg	Cfm/Ton	0.00	Plenum	0.0	61.0
Aux Htg	0.0		0 0.	0.0	Supply		0	0	Clg	Sqft/Ton	0.00	Return	0.0	61.0
Preheat	0.0		0 .0.	0.0	Mincfm		0	0	Clg	Btuh/Sqft	0.00	Ret/OA	0.0	61.0
Reheat	0.0		0 0.	0.0	Return		0	0	No.	People	0	Runarnd	0.0	61.0
Humidif	0.0		0 0.	0.0	Exhaust		0	0	Htg	% OA	0.0	Fn MtrTD	0.0	0.1
Opt Vent	0.0		0 0.	0.0	Rm Exh		0	0	Htg	Cfm/SqFt	0.00	Fn 8ldTD	0.0	0.1
Total	-120.0				Auxil		0	0	Htg	Btuh/SqFt	-21.98	Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2 IR HEATERS - BLDG. 1644

(At time of Coil Peak)

			Venti	lation	Op.	Vent	Rei	neat	Hum	idif	
Room			Airflow	Sensible		Sensible		Sensible		Latent	Total
Number		Description	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Btuh)
1		FLOOR	0	0	0	0	0	0	0	0	0
Zone	10. 1	Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	•	Block	-0-	0	0	0	0	0	0	0	0
-		Total/Ave.	0	0	0	0	0	0	0	0	0
System	1	iotal/Ave.	v	•	_	-	_			0	n
System	1	Block	0	0	0	0	0	0	U	U	· ·

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2 IR HEATERS - BLDG. 1644

(At time of Coil Peak)

						- Heating	·····					
		Supply	Return	System		System	Room			Run		System
		Fan	Fan	Exhaust		Exhaust	Exhaust	Ducted	Plenum	Around	Corridr	Return
Room		Heat	Heat	Heat Loss	Total	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow
Number	Description	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	. 0	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 2 IR HEATERS - BLDG. 1644

BUILDING U-VALUES-----

	Room U-Values(Btu/hr/sqft/F)										Room Mass	Room Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	Exflr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST FLOOR	0.000	0.750	0.000	0.000	0.200	0.000	0.000	ó.220	0.000	71.8	15.25
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.200	0.000	0.000	0.220	0.000	71.8	15.25
System	1 Total/Ave.					0.200	0.000	0.000	0.220	0.000	71.8	15.25
Buildin		0.000			0.000	0.200	0.000	0.000	0.220	0.000	71.8	15.25

BUILDING AREAS - ALTERNATIVE 2 IR HEATERS - BLDG. 1644

BUILDING AREAS -----

Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
				5,459	5,459	0	312	0	0	5,459	0	0	5,604
1	1ST FLOOR	1	1	3,439	5,459	0	312	0	0	5,459	0	0	5,604
Zone	1 Total/Ave.				•		312	0	0	5,459	0	0	5,604
System Buildir	1 Total/Ave. ng	•			5,459 5,459	0	312	0		5,459	0	0	5,604

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

System Totals

Percent	Cool	ing Load	d	Heatin	g Load		Cooling	Airflow		Heating	Airflow	•
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-6,000	3	34	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-12,000	4	45	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-18,000	5	57	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-24,000	5	61	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-30,000	5	60	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-36,000	6	68	0.0	0	0	0.0	0	0
30 - 35	5 0.0	0	0	-42,000	6	73	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-48,000	6	73	0.0	0	0	0.0	0	0
40 - 45	5 0.0	0	0	-54,000	7	<i>7</i> 5	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-60,000	12	138	0.0	0	0	0.0	0	0
50 - 5	5 0.0	0	0	-66,000	14	161	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-72,000	7	83	0.0	0	0	0.0	0	0
60 - 69	5 0.0	0	0	-78,000	7	79	0.0	0	0	0.0	0	0
65 - 79	0.0	0	0	-84,000	8	89	0.0	0	0	0.0	0	0
70 - 7	5 0.0	0	0	-90,000	4	48	0.0	0	0	0.0	0	0
75 - 8	0.0	0	0	-96,000	0	0	0.0	0	0	0.0	0	0
80 - 8	5 0.0	0	0	-102,000	0	0	0.0	0	0	0.0	0	0
85 - 9	0.0	0	O,	-108,000	0	0	0.0	0	0	0.0	0	0
90 - 9	5 0.0	0	Ó	-114,000	0	0	0.0	0	0	0.0	0	0
95 - 10	0.0	0	8	-120,000	0	0	0.0	0	0	0.0	0	0
Hours O	ff 0.0	0	8,760	0	0	7,616	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

	ELEC On Peak	DEMAND On Peak	GAS On Peak	GAS DMND On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	2,113	11	316	1
Feb	1,894	11	221	1
March	2,161	11	13	1
April	1,908	10	0	0
May	2,073	10	0	0
June	2,061	10	0	0
July	1,920	10	0	0
Aug	2,150	10	0	0
Sept	1,908	10	0	0
Oct	2,073	10	0	0
Nov	1,921	11	19	1
Dec	2,012	11	192	1
Total	24,193	11	761	1

Building Energy Consumption = 29,065 (Btu/Sq Ft/Year)
Source Energy Consumption = 29,496 (Btu/Sq Ft/Year)

Floor Area = 5,459 (Sq Ft)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

Grand Total

U T I L I T Y	EAK CHECKSUMS	
Utility ELECTRIC DEMAND		
Peak Value 10.8 (kW) Yearly Time of Peak 9 (hr) 1 (mo)		
Hour 9 Month 1		
Sub Total	0.0 0.00	
Heating Equipment		
1 EQ2201 GAS FIRED UNIT HEATER	0.3 2.60	
Sub Total	0.3 2.60	
Sub Total	0.0 0.00	
Sub Total	0.0 0.00	
Miscellaneous		
Lights Base Utilities Misc Equipment Sub Total	10.5 97.40 0.0 0.00 0.0 0.00 10.5 97.40	
Sup locat		

10.8 100.00

PAGE 1

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            ANALYSIS
TRACE 600
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ESOS STUDY AT WSMR - BUILDING 1680 WHITE SANDS MISSILE RANGE NM US ARMY EMC ENGINEERS, INC.

INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

ELPASO.W Weather File Code: Location: 31.0 (deg) Latitude: 106.0 (deg) Longitude: 6 Time Zone: 3,918 (ft) Elevation: 25.8 (in. Hg) Barometric Pressure: 1.00 Summer Clearness Number: 1.00 Winter Clearness Number: 98 (F) Summer Design Dry Bulb: 64 (F) Summer Design Wet Bulb: Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 0.20 Winter Ground Relectance:

0.0653 (Lbm/cuft) Air Density: 0.2444 (Btu/lbm/F) Air Specific Heat: Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) 4,214.8 (Btu-min./hr/cuft) Latent Heat Factor: 3.9171 (Lb-min./hr/cuft) Enthalpy Factor:

Design Simulation Period: May To October System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

9:20: 1 1/16/92 Time/Date Program was Run: 1680 .TM Dataset Name:

D6-63

- UNIT HEATERS UH Block

Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Mo/Hr: 0/ 0 Peaked at Time ==> OADE: 24 OADB/WB/HR: 0/ 0/ 0.0 OADB: 0 Outside Air ==> Percnt * Coil Peak Percnt Space Peak Ret. Air Ret. Air Net Percnt * Space Space Tot Sens Of Tot * Space Sens Latent Total Of Tot Sensible Sensible Sens.+Lat. (%) (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (8) (Btuh) (Btuh) Envelope Loads 0.00 ٥ 0 0.00 0 0 0.00 ٥ n Skylite Solr 0.00 0.00 0 ٥ 0 ٥ ٥ 0.00 Skylite Cond -74,280 14.05 0.00 * -74,280 ۵ 0 0.00 0 a Roof Cond 0 0.00 0.00 * 0 0 0.00 a 0 0 Glass Solar 42.56 0 0.00 * -224,953 -224,953 0.00 * 0 0 0 Glass Cond 0.00 * -150,061 -150,061 0.00 ٥ 0 0 Wall Cond 0 0 0.00 0.00 0 0.00 0 ٥ Partition -15,929 3.01 0.00 -15,929 0.00 * 0 ٥ Exposed Floor 0 -69,473 13.14 0.00 * -69.473 0.00 * a Infiltration ٥ 0.00 * -534,695 -534,695 101.15 0.00 * 0 Sub Total ==> 0 Internal Loads 0 0.00 0.00 * 0.00 * 0 0 0 Lights 0 0.00 0 0.00 0.00 ٥ 0 People a 0 0.00 0 0.00 * 0 0.00 ٥ ٥ 0 Misc 0.00 0 0.00 0 0.00 * 0 0 0 ٥ 0 Sub Total ==> 0.00 0.00 * 0 0 0.00 0 0 ٥ 0 Ceiling Load 0 0.00 0.00 ٥ 0.00 n 0 Outside Air 6,080 0.00 * 0.00 * Sup. Fan Heat 0 0.00 0.00 * ٥ ۵ Ret. Fan Heat 0 0.00 0.00 * 0.00 * 0 Duct Heat Pkup 0.00 0.00 * 0 0 0.00 * ٥ OV/UNDR Sizing ٥ 0.00 0 a 0.00 0.00 * ٥ 0 Exhaust Heat 0 0.00 0.00 0.00 ٥ n Terminal Bypass 0.00 * -528,614 100.00 -534,695 0.00 * 0 Grand Total => -----COOLING COIL SELECTION-----------AREAS-----Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) Total Capacity Sens Cap. Coil Airfl Deg F Deg F Grains 12,078 Floor (cfm) Deg F Deg F Grains (Mbh) (Mbh) (Tons) 0.0 Part 0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Main Clg 0.0 518 ExFlr 0.0 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 Aux Clg 0 0.0 0.0 Roof 12.078 0 0.0 0.0 0.0 ٥ 0.0 0.0 0.0 Opt Vent 0.0 Wall 13,134 4,356 33 0.0 Totals --TEMPERATURES (F)-----ENGINEERING CHECKS-------AIRFLOWS (cfm)-----------HEATING COIL SELECTION-----Clσ Htg 0.0 Type Clg % OA Cooling Capacity Coil Airfl Type Ent Lvq 0.0 97.7 Clg Cfm/Sqft 0.00 SADB 0 Deg F Deg F Vent (Mbh) (cfm) 0.0 65.0 Clq Cfm/Ton 0.00 Plenum 1.770 17,100 50.5 97.7 Infil 0 -771.4 Main Htg Return 0.0 65.0 Clg Sqft/Ton 0.00 0 17,100 0 0.0 0.0 Supply Aux Htg 0.0 Ret/OA 0.0 65.0 0.00 0 Clg Btuh/Sqft 0 0.0 0.0 Mincfm Preheat 0.0 O 0.0 65.0 0 Runarnd 0 17,100 No. People 0 0.0 0.0 Return Reheat 0.0 0.0 Fn MtrTD 0.0 0.1 Htg % OA 0 0 0.0 0.0 Exhaust 0.0 Humidif Fn BldTD 0.0 0.1 1.42 Htq Cfm/SqFt 0 ٥ 0.0 Rm Exh Opt Vent 0.0 0.0 0.2 Fn Frict Htg Btuh/SqFt -63.87 -771.4 Auxil Total

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1 BASELINE BUILDING 1680

(At time of Coil Peak)

		Vent	llation	Op.	Vent	Re	heat	Hum:	ld1f	
Room		Airflow	Sensible		Sensible		Sensible	Airflow	Latent	Total
Number	Description	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Btuh)
1	1ST FLOOR	0	0	0	0	0	0	0	0	0
_		0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0
-	1 Block	0	0	0	0	0	0	0	0	0
Zone Zone System System	1 Total/Ave. 1 Block 1 Total/Ave. 1 Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1680

(At time of Coil Peak)

						- Heating	,					
		Supply	Return	System		System	Room			Run		System
		Fan	Fan	Exhaust			Exhaust				Corridr	
Room		Heat	Heat	Heat Loss	Total	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow	
Number	Description	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)
										_	•	17 100
1	1ST FLOOR	6,080	0	0	6,080	0	0	0	0			
Zone	1 Total/Ave.	6,080	0	0	6,080	0	0	0	0	0	0	- •
Zone	1 Block	6,080	0	0	6,080	0	0	0	0	0	0	17,100
	1 Total/Ave.	·	0	0	6,080	0	0	0	0	0	0	17,100
System		•	0	0	6,080	0	0	0	0	0	0	17,100
System	1 Block	6,080	U	•	3,000							

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1680

BUILDING U-VALUES-----

				Room	Room								
						(Btu	/hr/sqf	t/F)				Mass	Capac.
Poom	Room Summr Wintr								Wintr			(lb/	(Btu/
Number	Desc	ription	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST F	LOOR	0.000	0.750	0.000	0.000	0.150	1.140	1.259	0.417	0.000	41.4	8.94
Zone	1	Total/Ave.	0.000	0.750	0.000	0.000	0.150	1.140	1.259	0.417	0.000	41.4	8.94
System	1	Total/Ave.	0.000	0.750	0.000	0.000	0.150	1.140	1.259	0.417	0.000	41.4	8.94
Buildin	g	/	0.000	0.750	0.000	0.000	0,150	1.140	1.259	0.417	0.000	41.4	8.94

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1680

BUILDING AREAS -----

Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
				10.078	12,078	0	518	0	0	12,078	4,356	33	8,778
. 1	1ST FLOOR	1	1	12,078	12,078	0	518	0	0	12,078	4,356	33	8,778
Zone	1 Total/Ave.				12,078	0	518	0	0	12,078	4,356	33	8,778
System Buildin	1 Total/Ave.				12,078	0	518	0	0	12,078	4,356	33	8,778

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

SYSTEM LOAD PROFILE -----

System Totals

Percent	Cool	ing Load	d	Heatir	g Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(\$)	
					_		855.0	0	o	0.0	0	o
0 - 5	0.0	0	0	-38,569	6	103		=	0	0.0	0	0
5 - 10	0.0	0	0	-77,138	12	197	1,710.0	0	_		٥	0
10 - 15	0.0	0	0	-115,707	6	97	2,565.0	0	0	0.0	-	-
15 - 20	0.0	0	0	-154,276	6	102	3,420.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-192,845	8	133	4,275.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-231,414	7	120	5,130.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-269,983	15	240	5,985.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-308,552	16	265	6,840.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-347,121	8	130	7,695.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-385,690	12	196	8,550.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-424,259	3	41	9,405.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-462,828	0	0	10,260.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-501,397	0	0	11,115.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-539,966	0	0	11,970.0	0	. 0	0.0	0	0
70 - 75	0.0	0	0	-578,535	0	0	12,825.0	. 0	0	0.0	0	0
75 - 80	0.0	0	0	-617,104	0	0	13,680.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-655,673	0	0	14,535.0	0	0	0.0	0	0
	0.0	0	0	-694,242	0	0	15,390.0	0	0	0.0	0	0
85 - 90			0	-732,811	0	0	16,245.0	0	0	0.0	0	0
90 - 95	0.0	0	-	•	0	0	17,100.0	100	8,760	0.0	0	0
95 - 100	0.0	0	0	-771,380			0.0	. 0	0	0.0	0	8,760
Hours Off	0.0	0	8,760	0	0	7,136	0.0	U	J	•••	_	-,

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

 MONTHLY	ENERGY	CONSUMPTION

	ELEC	DEMAND	GAS	GAS DMND	
	On Peak	On Peak	On Peak	On Peak	
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)	
Jan	7,025	34	1,968	7	
Feb	6,249	34	1,315	6	
March	6,877	34	243	4	
April	6,001	33	0	0	
May	6,522	33	0	0	
June	6,482	33	0	0	
July	6,041	33	0	0	
Aug	6,763	33	0	0	
Sept	6,001	33	0	0	
Oct	6,522	33	0	0	
Nov	6,196	34	541	4	
Dec	6,768	34	1,379	5	
Total	77,447	34	5,445	7	
Building Energ	gy Consumption	= 66,	967 (Btu/S	Tt/Year)	
Source Energy			361 (Btu/S	q Ft/Year)	

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

UTILITY PEAK CHECKSUMS-----

15+474+17	FIRCTRIC	DEMAND

Peak Value 34.0 (kW)
Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1		
Sub Total	0.0	0.00
Heating Equipment		
1 EQ2201 GAS FIRED UNIT HEATER	1.0	2.94
Sub Total	1.0	2.94
Sub Total	0.0	0.00
Sub Total	0.0	0.00
Miscellaneous		
Lights	33.0	97.06
Base Utilities	0.0	0.00
Misc Equipment	0.0	0.00
Sub Total	33.0	97.06
Grand Total	34.0	100.00

D6-70

ESOS STUDY AT WSMR - BUILDING 1680
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.

INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Weather File Code: ELPASO.W

Location:

માં<u>કેલ્લ</u>કારાકા

Latitude: 31.0 (deg)
Longitude: 106.0 (deg)
Time Zone: 6
Elevation: 3,918 (ft)

Barometric Pressure: 25.8 (in. Hg)

Summer Clearness Number: 1.00
Winter Clearness Number: 1.00
Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20

Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 2:41:50 1/21/92

Dataset Name: 1680 .TM

*લાજસાસ*સાર

System	1	Block	RAD	- RADIA	FION										
*****	*****	*****	COOLING COI	L PEAK ****	*****	*****	*****	****	* CLG SPA	CE PEAK ***	****	***** HE/	ATING COII	PEAK	***
Peaked a			Mo/Hr:	0/0				*	Mo/Hr:		*		Mo/Hr:		
Outside	Air ==>	(DADB/WB/HR:	0/ 0/ 0	0.0			*	OADB:	0	*		OADB:		
		Space	Ret. Air	r Ret. Air	· "	let P	ercnt	*	Space	Percni	+ *	Space Pe	aak Coil	Peak	Percnt
		Sens.+Lat.					f Tot	*	Sensible			Space Se		Sens	Of Tot
Envelope	Loads	(Btuh)					(%)	*	(Btuh)			(Bti		(Btuh)	
	e Solr	(=) (5(4.7)	(510	0	0.00	*	0			(60)	0	0	(%)
	e Cond	Ò)		0	0.00	*	0				0	0	0.00
Roof C		ì)		0	0.00	*	0	****		-67,0			0.00
Glass		ì	•	,)		0	0.00	*	0			-01,0	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	6 7, 033 0	13.89
Glass		ì		-		0	0.00	*	0			-203,1	-	3,103	0.00 42.08
Wall C		Č				0	0.00	*	0					•	
Partit		Č	•			0		*	0			-135,4		5,421	28.06
	d Floor	Č				0	0.00	*	0			.47.7	0	0	0.00
·-	ration	Č				0	0.00	*	0	0.00		-14,3		4,374	2.98
	tal==>	C		,		0	0.00	•	_	0.00		-62,6		2,695	12.99
Internal		•	`	,		U	0.00		0	0.00	*	-482,6	20 -48	2,626	100.00
Lights		0) (1		0	0.00	*	0	0.00	*		0	0	0.00
People		0				0	0.00	*	0	0.00	*		0	0	0.00
Misc		0) 0		0		*	0	0.00			0	0	0.00
Sub To	tal==>	0	_	-		0		*	0	0.00	*		0	0	0.00
Ceiling	Load	0		-		0		*	0	0.00	*		0	0	0.00
Outside /		0	_			0	0.00	*	0	0.00	*		0	0	0.00
Sup. Fan	Heat		_	•		0		*	•	0.00	*		U	0	0.00
Ret. Fan			c)		0	0.00	*		0.00	*			0	0.00
Duct Hea	t Pkup		G			0	0.00	*		0.00	*			0	0.00
OV/UNDR S	•	0				0		*	0	0.00	*		0	0	
Exhaust (Heat		. 0	0		0		*		0.00	*		•	0	0.00
Terminal	Bypass		C	0		0	0.00	*		0.00	*			0	0.00
								*		****	*			·	0.00
Grand To	tal==>	0	0	0		0	0.00	*	0	0.00	*	-482,6	26 -48	2,626	100.00
********			coo	LING COIL	SELECTION-							••••••	AREAS		
	Total	Capacity	Sens Cap.	Coil Airf	l Ente	ring l	DB/WB/H	HR	Leaving	DB/WB/HR		Gross Tot	al Gt	ass (sf	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F	Deg F	Grair	ns De	g F Deg	F Grains	ı	loor	12,078		
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.	.0	0.0 0.	0.0	F	Part	0		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.	.0	0.0 0.	0.0	E	xFlr	518		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.	.0	0.0 0.	0.0	ş	Roof	12,078		0 0
Totals	0.0	0.0									١	lall	13,134	4,3	56 33
	HEATI	NG COIL SE	LECTION			AIRFLO	OWS (cf	fm)		-ENGINEERI	NG C	HECKS	TEMPE	RATURES	(F)
	Capaci	ty Coil	Airfl Ent	Lvg	Type	Cod	oling	Heat	ing (lg % OA		0.0	Type	Clg	Htg
	(Mbh		fm) Deg F	Deg F	Vent		0		0 0	lg Cfm/Sqf	t	0.00	SADB	0.0	
Main Htg	-500		0.0		Infil		0	1	,770 c	lg Cfm/Ton		0.00	Plenum	0.0	
Aux Htg		.0	0 0.0	0.0	Supply		0		0 0	lg Sqft/To	n	0.00	Return	0.0	
Preheat		.0	0 0.0	0.0	Mincfm		0		0 0	lg Btuh/Sq	ft	0.00	Ret/OA	0.0	61.0
Reheat		.0	0 0.0	0.0	Return		0		0 N	o. People		- 0	Runarnd	0.0	
Humidif		.0	0.0		Exhaust		0		0 н	tg % OA		0.0	Fn MtrTl	0.0	
Opt Vent		.0	0 0.0	0.0	Rm Exh		0		0 н	tg Cfm/SqF	t	0.00	Fn BldTi	0.0	0.1
Total	-500	.0			Auxil		0		0 н	tg Btuh/Sq	Ft	-41.40	Fn Fric	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2 IR HEATERS BLDG. 1680

------AIRFLOW HEATING LOADS------(At time of Coil Peak)

			Venti	ilation	Op.	Vent	Rel	heat	Hum	idif	
Room			Airflow	Sensible	Airflow	Sensible	Airflow	Sensible	Airflow	Latent	Total
Number		Description	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Btuh)
1	1ST F	LOOR	0	0	0	0	0	0	0	0	0
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1	Block	0	0	0	0	0	0	0	0	0
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0
System	1	Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2 IR HEATERS BLDG. 1680

(At time of Coil Peak)

		•					- Heatin	g					• • • • • • • •
			Supply	Return	System		System	Room			Run		System
			Fan	Fan	Exhaust		Exhaust	Exhaust	Ducted	Plenum	Around	Corridr	Return
Room			Heat	Heat	Heat Loss	Total	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow
Number	Descri	iption	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)
1	1ST FLOOR		0	0	0	0	0	0	0	0	0	0	0
Zone	1 Tota	l/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Bloc	:k	0	0	0	0	0	0	0	0	0	0	0
System	1 Tota	l/Ave.	0	0	0	0	0	0	0	0	0	0	0
System	1 Bloc	:k	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 2 IR HEATERS BLDG. 1680

BUILDING U-VALUES------

		(Btu/hr/sqft/F)											Room Capac.
Room					Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Desc	ription	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST F											41.4	8.94
Zone	1	Total/Ave.	0.000	0.750	0.000	0.000	0.150	1.140	1.259	0.417	0.000	41.4	8.94
System	1	Total/Ave.	0.000	0.750	0.000	0.000	0.150	1.140	1.259	0.417	0.000	41.4	8.94
Building	3		0.000	0.750	0.000	0.000	0.150	1.140	1.259	0.417	0.000	41.4	8.94

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BUILDING AREAS - ALTERNATIVE 2 IR HEATERS BLDG. 1680

------BUILDING AREAS ------

				Floor	Total		Exposed						
		Numb	er of	Area/Dupl	Floor	Partition	Floor	Skylight	Skl	Net Roof	Window	Win	Net Wall
Room		Dupl	icate	Room	Area	Area	Area	Area	/Rf	Area	Area	/Wl	Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	1ST FLOOR	1	1	12,078	12,078	0	518	0	0	12,078	4,356	33	8,778
Zone	1 Total/Ave.				12,078	0	518	0	0	12,078	4,356	33	8,778
System	1 Total/Ave.				12,078	0	518	0	0	12,078	4,356	33	8,778
Buildir	19				12,078	0	518	0	0	12,078	4,356	33	8,778

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System Totals

Percent			Heating Load			Cooling	Airflo	4	Heating Airflow			
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-25,000	4	50	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-50,000	6	64	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-75,000	3	35	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-100,000	4	42	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-125,000	7	83	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-150,000	8	85	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-175,000	7	81	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-200,000	3	39	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-225,000	8	91	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-250,000	6	67	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-275,000	15	172	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-300,000	6	72	0.0	0	. 0	0.0	0	0
60 - 65	0.0	0	0	-325,000	7	78	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-350,000	13	149	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-375,000	1	10	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-400,000	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-425,000	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-450,000	0	Ō	0.0	0	Ö	0.0	0	0
90 - 95	0.0	0	0	-475,000	0	0	0.0	0	ō	0.0	0	0
95 - 100	0.0	0	0	-500,000	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,642	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

------ MONTHLY ENERGY CONSUMPTION ------

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	6,911	34	1,237	5
Feb	5,955	34	811	5
March	6,803	34	47	3
April	6,001	33	0	0
May	6,522	33	0	0
June	6,482	33	0	0
July	6,041	33	0	0
Aug	6,763	33	0	0
Sept	6,001	33	0	0
Oct	6,522	33	0	0
Nov	6,208	34	151	3
Dec	6,469	34	809	4
Total	76,678	34	3,054	5

Building Energy Consumption = Source Energy Consumption =

46,956 (Btu/Sq Ft/Year) 47,738 (Btu/Sq Ft/Year) Floor Area =

12,078 (Sq Ft)

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ESOS STUDY AT WSMR - BUILDING 1751
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F)

Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20
Air Density: 0.0653 (Lbm/cuft)

Air Specific Heat:

Density-Specific Heat Prod:

Latent Heat Factor:

Enthalpy Factor:

0.2444 (Btu-lbm/F)

(Btu-min./hr/cuft/F)

4,214.8 (Btu-min./hr/cuft)

(Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 13:41:38 1/20/92
Dataset Name: 1751 .TM

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Total

-894.4

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System Block IIH - UNIT HEATERS Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: O OADB: 24 Space Ret. Air Ret. Air Net Percnt * Space Percnt * Space Peak Coil Peak Sens.+Lat. Sensible Total Of Tot * Of Tot * Latent Sensible Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr 0 o 0.00 0 0 0.00 * 0 ٥ 0.00 Skylite Cond ٥ ٥ ٥ 0.00 0 -0.00 * n ٥ 0.00 0.00 Roof Cond O n ٥ ٥ 0.00 * -92,697 -92,697 19.92 Glass Solar ٥ ٥ 0 0.00 * 0.00 * 0 Glass Cond 0 0.00 0.00 * -41,795 -41,795 8.98 Wall Cond 0 0 0.00 * 0.00 * -121,673 0 -121,673 26.14 Partition 0 0 0.00 * 0 0.00 * 0 0 0.00 Exposed Floor 0.00 0 0 0 0.00 -11,891 -11,891 2.55 0.00 * Infiltration 0 0 0.00 * 43.86 ٥ -204,143 -204,143 Sub Total ==> O ٥ 0.00 * 0.00 * -472,200 -472,200 101.45 Internal Loads 0 0.00 * Lights 0 0 0 0.00 * 0 0 0.00 People 0.00 * 0.00 ٥ ٥ 0 0 ٥ 0.00 Misc 0 ٥ O 0 0.00 * 0 0.00 0 0.00 0 Sub Total ==> 0 0 0 0 0.00 * 0 0.00 0 0.00 Ceiling Load 0.00 0.00 0 0 0 0 0 0.00 Outside Air 0 0.00 . * 0.00 0 0.00 Sup. Fan Heat 0 0.00 * 0.00 6,747 -1.45 Ret. Fan Heat 0.00 0.00 ٥ 0 0 0.00 0.00 0.00 * Duct Heat Pkup O ٥ 0 0.00 OV/UNDR Sizing 0 0.00 * 0.00 * Exhaust Heat 0.00 0.00 0 Terminal Bypass 0.00 0.00 0 0.00 0.00 * Grand Total ==> 0 0 0.00 * -472,200 -465,453 100.00 -----COOLING COIL SELECTION-----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Mbh) (Tons) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 18.087 Main Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Part 0 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 387 Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 18,087 0 0 Totals 0.0 0.0 Wall 11.668 809 -----HEATING COIL SELECTION----------AIRFLOWS (cfm)-------ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Lvg Type Cooling Heating Clg % OA 0.0 Туре Clg Htg (Mbh) (cfm) Deg F Deg F 0 Clg Cfm/Sqft 0.00 SADB 0.0 91.0 -894.4 18,975 Main Htg 41.8 91.0 Infil 0 5,200 Clg Cfm/Ton 0.00 Plenum 0.0 65.0 Aux Htg 0.0 0 0.0 0.0 Supply 0 18,975 Clg Sqft/Ton 0.00 Return 0.0 65.0 Preheat. 0.0 0 0.0 0.0 Mincfm O Clg Btuh/Sqft n 0.00 Ret/OA 0.0 65.0 Reheat 0.0 0 0.0 0.0 Return 0 18,975 No. People 0 Runarnd Humidif 0.0 0 0.0 0.0 Exhaust 0 0 Htg % OA 0.0 Fn MtrTD 0.0 0.1 Opt Vent 0.0 0.0 0.0 Rm Exh ٥ 0 Hta Cfm/SaFt 1.05 Fn BldTD 0.0 0.1

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0

Htg Btuh/SqFt -49.45

Fn Frict

0.0

0.2

Auxil

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1

BASELINE BUILDING 1751

----- AIRFLOW HEATING LOADS------(At time of Coil Peak)

Ventilation Op. Vent Reheat Humidif										
Room		Airflow	Sensible	Airflow	Sensible	Airflow	Sensible	Airflow	Latent	Total
Number	Description	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Btuh)
1	HI-BAY AREA	0	0	0	0	0	0	0	0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0
System	<pre>1 Total/Ave.</pre>	0	0	0	0	0	0	0	0	o
System	1 Block	0	0	0	0	0	0	0	0	o

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1 BASELINE BUILDING 1751

------ AIRFLOW HEAT GAIN AND LOSS------- AIRFLOW HEAT GAIN AND (At time of Coil Peak)

						- Heating	g					
		Supply	Return	System		System	Room			Run		System
		Pan	Fan	Exhaust		Exhaust	Exhaust	Ducted	Plenum	Around	Corridr	Return
Room		Heat	Heat	Heat Loss	Total	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow
Number	Description	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)
1	HI-BAY AREA	6,747	0	0	6,747	0	0	0	0	0	0	18,975
Zone	1 Total/Ave	6,747	0	0	6,747	0	0	0	0	o	0	18,975
Zone	1 Block	6,747	0	0	6,747	0	0	0	0	0	0	18,975
System	1 Total/Ave	6,747	0	0	6,747	0	0	0	0	0	0	18,975
System	1 Block	6,747	0	0	6,747	0	0	0	o	0	0	18,975

BUILDING U-VALUES - ALTERNATIVE 1 BASELINE BUILDING 1751

------ BUILDING U-VALUES------

		Room U-Values(Btu/hr/sqft/F)							Room Mass	Room Capac.		
Room				Summr	Wintr		Summr	Wintr			(1b/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	HI-BAY AREA	0.000	0.750	0.000	0.000	0.125	1.140	1.259	0.273	0.000	76.1	16.11
Zone	<pre>1 Total/Ave.</pre>	0.000	0.750	0.000	0.000	0.125	1.140	1.259	0.273	0.000	76.1	16.11
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.125	1.140	1.259	0.273	0.000	76.1	16.11
Building	J	0.000	0.750	0.000	0.000	0.125	1.140	1.259	0.273	0.000	76.1	16.11

BUILDING AREAS - ALTERNATIVE 1

BASELINE BUILDING 1751

-BUILDING AREAS

Room			er of icate	Floor Area/Dupl Room	Total Floor Area	Partition Area	Exposed Floor Area	Skylight Area	Skl /Rf	Net Roof	Window Area	Win /Wl	Net Wall Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	HI-BAY AREA	1	1	18,087	18,087	0	387	0	0	18,087	809	7	10,859
Zone	1 Total/Ave.				18,087	0	387	0	0	18,087	809	7	10,859
System	1 Total/Ave.				18,087	0	387	0	0	18,087	809	7	10,859
Building	g				18,087	0	387	0	٥	18,087	809	7	10,859

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Design	Coolin Cap. H (Ton)	·	Heating Capacity (Btuh)		 Hours	Cooling Cap. (Cfm)	Airflow ' Hours	lours	Heating / Cap- (Cfm)	Airflow - Hours H (%)	ours 0
0 - 5 5 - 10 10 - 15 15 - 20 20 - 25 25 - 30 30 - 35 35 - 40 40 - 45 45 - 50 50 - 55 55 - 60 60 - 65 65 - 70 70 - 75 75 - 80 80 - 85 85 - 90 90 - 95 95 - 100 Hours Off	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0 0 0 0 0 0 0 0 0 0 0	-44,720 -89,440 -134,160 -178,880 -223,600 -268,320 -313,040 -357,760 -402,480 -447,200 -491,920 -536,640 -581,360 -626,080 -670,800 -715,520 -760,240 -804,960 -849,680 -894,400	!	0 0 0	17,077。 18,026。 18,975。	0 0 0 3 0 3 0 5 0 0 8 0 0 8 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0		

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MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

----- MONTHLY ENERGY CONSUMPTION -----

	ELEC On Peak	DEMAND On Peak	GAS On Peak	GAS DMND On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	3,177	15	1,749	6
Feb	2,873	15	1,325	6
March	3,305	15	343	3
April	2,647	15	0	0
May	2,876	15	0	0
June	2,859	15	0	0
July	2,664	15	0	0
Aug	2,983	15	0	0
Sept	2,647	15	0	0
Oct	2,876	15	0	0
Nov	2,943	15	524	3
Dec	3,071	15	1,276	5
Total	34,921	15	5,216	6

Building Energy Consumption = Source Energy Consumption =

35,429 (Btu/Sq Ft/Year) 36,321 (Btu/Sq Ft/Year) Floor Area =

18,087 (Sq Ft)

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UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

UTILITY FEAR GRECKSUMS - ALTERNATIVE T			
U T I L I T Y	PEAK CHEC	K S U M	s
Utility ELECTRIC DEMAND			
Peak Value 15.1 (kW)			
Yearly Time of Peak 9 (hr) 1 (mo)			
Hour 9 Month 1			
Sub Total	0.0	0.00	•
Heating Equipment			
1 EQ2201 GAS FIRED UNIT HEATER	0.5	3.63	
Sub Total	0.5	3.63	
Sub Total	0.0	0.00	
Sub Total	0.0	0.00	
Miscellaneous			
Lights	14.5	96.37	
Base Utilities	0.0	0.00	
Misc Equipment	0.0	0.00	
Sub Total	14.5	96.37	
Grand Total	15.1	100.00	

ESOS STUDY AT WSMR - BUILDING 1751
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO*17)

Weather File Code:	ELPASO	1.4
Location:		•
Latitude:	31.0	(deg)
Longitude:	106.0	. •
Time Zone:	6	•
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Deneity	0.0457	41 hm 4 6

is obtained in the constant of the constant

Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period:	May	To October
System Simulation Period:	January	To December
Cooling Load Methodology:	TETD.	/Time Averaging

Time/Date Program was Run:	14:17:24	1/21/91
Dataset Name:	1751 .	TM

By: Trane Customer Direct Service Network

- RADIATION Block RAD System 1

Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: 0 OADB: 24 Space Ret. Air Ret. Air Net Percnt Space Percnt * Space Peak Coil Peak Percnt Total Of Tot Sens.÷Lat. Sensible Latent Sensible Of Tot * Space Sens Tot Sens Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr 0 0 0 0.00 0 0.00 0 0 0.00 0.00 0.00 * Skylite Cond 0 0 0 0 ß 0 0.00 0.00 0.00 * Roof Cond 0 0 0 0 -83,653 -83,653 19.63 Glass Solar 0 0 0 0.00 0 0.00 0 0 0.00 Glass Cond 0 0 0 0.00 0 0.00 -37,735 -37,735 8.85 -109,803 0 0.00 0 0.00 * Wall Cond 0 0 -109.803 25.77 Partition 0.00 0.00 * 0 Ω 0 Ω 0 0.00 Exposed Floor 0.00 0 0.00 * -10,731 -10,731 2.52 0.00 * Infiltration n 0.00 -184,227 n n -184,227 43.23 0.00 * Sub Total==> n 0 0 0.00 0 -426,149 -426,149 100.00 Internal Loads 0.00 * Lights 0 Ω n 0.00n 0 n 0.00 People Λ Ω 0.00 ß 0.00 * a a 0.00 Misc U 0 ٥ 0.00 0 0.00 * 0 0 0.00 Sub Total==> 0 0 0.00 0 0.00 * 0 0 0 0.00 Ceiling Load ٥ 0.00 ۵ 0.00 * 0 0 0.00 Outside Air 0 0 0.00 0.00 * 0 0 0 0.00 Sup. Fan Heat 0.00 0.00 * 0 D 0.00 0.00 * Ret. Fan Heat Λ Λ 0.00 0 0.00 Duct Heat Pkup 0 0 0.00 0.00 0 0.00 OV/UNDR Sizing 0.00 0.00 0 0 0 Exhaust Heat 0 n 0.00 0.00 0 0 Terminal Bypass ٥ 0.00 0.00 n n n 0.00 Grand Total ==> 0.00 * 0.00 * -426,149 -426,149 100.00 -----COOLING COIL SELECTION------Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains 18,087 Floor Main Clg 0.0 0.0 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 Part 0 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 387 Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 18,087 Roof 0 0 0.0 Totals 0.0 Wall 11,668 809 ------HEATING COIL SELECTION----------AIRFLOWS (cfm)-------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Keating Ent Lvg Type Cooling Clg % OA 0.0 Type Clg Htg (Mbh) (cfm) Deg F Deg F Vent 0 0 Clg Cfm/Sqft 0.00 SADR 0.0 61.1 Main Htg -450.0 0 0.0 0.0 Infil 0 5,200 Clg Cfm/Ton 0.00 Plenum 0.0 Aux Htg 0.0 0 0.0 0.0 Supply 0 0 Clg Sqft/Ton 0.00 Return 0.0 61.0

ដែលមានបង្គម៉ាង

Preheat

Reheat

Humidif

Opt Vent

Total

0.0

0.0

0.0

0.0

-450.0

0

0

0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

Mincfm

Return

Exhaust

Rm Exh

Auxil

0

0

0

0

Clg Btuh/Sqft

Htg Cfm/SqFt

Htg Btuh/SqFt -24.88

No. People

Htg % OA

0.00

ū

0.0

0.00

Ret/OA

Runarnd

Fn MtrTD

Fn BldTD

En Frict

0.0

0.0

0.0

0.0

0.0

61 0

61.0

0.1

0.1

0.2

0

0

0

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2 INFRARED HEATERS - 1751

------ AIRFLOW HEATING LOADS----- (At time of Coil Peak)

Ventilation Op. Vent Reheat Humidif													
Room			Airflow	Sensible	Airflow	Sensible	Airflow	Sensible	Airflow	Latent	Total		
Number		Description	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Btuh)		
1	HI-BA	Y AREA	0	0	0	0	0	0	0	0	0		
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0		
Zone	1	Block	0	0	0	0	0	0	0	0	0		
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0		
System	1	Block	0	0	0	0	0	0	0	0	0		

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2 INFRARED HEATERS - 1751

------AIRFLOW HEAT GAIN AND LOSS------(At time of Coil Peak)

		*************				- Heatin	g		• • • • • • • • • • • • • • • • • • • •	• • • • • • • •		
		Supply	Return	System		System	Room			Run		System
		Fan	fan	Exhaust		Exhaust	Exhaust	Ducted	Plenum	Around	Corridr	Return
Room		Heat	Heat	Heat Loss	Total	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow
Number	Description	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)
1	HI-BAY AREA	0	0	0	0	0	0	0	0	0	. 0	0
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone	1 Block	0	0	0	0	0	0	0	0	0	0	0
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
System	1 Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 2
INFRARED HEATERS - 1751

Supplies property

											Room Mass	Room Capac.
Room Number	Description	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	(lb/ sqft)	(Btu/ sqft/F)
1	HI-BAY AREA						1.140				76.1	16.11
Zone System	 Total/Ave. Total/Ave. 										76.1 76.1	16.11 16.11
Buildin	g	0.000	0.750	0.000	0.000	0.125	1.140	1.259	0.273	0.000	76.1	16.11

BUILDING AREAS - ALTERNATIVE 2
INFRARED HEATERS - 1751

------BUILDING AREAS------



Room Number De	escription		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	•	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1 HI	I-BAY AREA	1	1	18,087	18,087	0	387	0	0	18,087	809	7	10,859
Zone	1 Total/Ave.				18,087	0	387	0	0	18,087	809	7	10,859
System	1 Total/Ave.				18,087	0	387	0	0	18,087	809	7	10,859
Building					18,087	0	387	0	0	18,087	809	7	10,859

ASHRAE 90 ANALYSIS - ALTERNATIVE 2 INFRARED HEATERS - 1751

marine ignis.

----- A S H R A E 90 A N A L Y S I S -----

Overall Roof U-Value = 0.125 (Btu/Hr/Sq Ft/F)
Overall Wall U-Value = 0.333 (Btu/Hr/Sq Ft/F)
Overall Building U-Value = 0.207 (Btu/Hr/Sq Ft/F)

Roof Overall Thermal Transfer Value (OTTVr) = 7.17 (Btu/Hr/Sq Ft) Wall Overall Thermal Transfer Value (OTTVw) = 14.82 (Btu/Hr/Sq Ft)

System Totals

Percent	Cool	ing Loa	ad	Heati	ng Load		Cooling	Airflo		Heating	Airflo	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	•
0 - 5	0.0	0	0	-22,500	12	225	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-45,000	7	131	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-67,500	5	95	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-90,000	9	177	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-112,500	10	189	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-135,000	15	275	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-157,500	9	172	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-180,000	15	293	0.0	0	0	0.0	0	0
40 - 45	0.0	.0	0	-202,500	8	149	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-225,000	8	147	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-247,500	2	41	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-270,000	0	0	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-292,500	0	0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-315,000	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-337,500	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-360,000	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-382,500	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-405,000	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-427,500	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	. 0	-450,000	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,866	0.0	0	8,760	0.0	0	8,760

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MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

 MONTHLY	ENERGY	CONSUMPTION -
11 O 11 11 L 1	_ ~ _ ~ ~ ~ .	COMBUNETTON

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	3,166	15	1,190	4
Feb	2,776	15	853	4
March	3,061	15	50	2
April	2,647	15	0	0
May	2,876	15	0	0
June	2,859	15	0	0
July	2,664	15	0	0
Aug	2,983	15	0	0
Sept	2,647	15	0	0
0ct	2,876	15	0	0
Nov	2,729	15	114	2
Dec	2,959	15	798	3
Total	34,243	15	3,004	4

Building Energy Consumption =
Source Energy Consumption =

23,069 (Btu/Sq Ft/Year) 23,582 (Btu/Sq Ft/Year)

Floor Area =

18,087 (Sq Ft)

additional by

againtaine.

U T I L I T Y	PEAK CHE	CKSUMS	·
Utility ELECTRIC DEMAND			
Peak Value 15.1 (kW) Yearly Time of Peak 9 (hr) 1 (mo)			
Hour 9 Month 1			
Sub Total	0.0	0.00	
Heating Equipment			
1 EQ2201 GAS FIRED UNIT HEATER	0.5	3.63	
Sub Total	0.5	3.63	
Sub Total	0.0	0.00	
Sub Total	0.0	0.00	
Miscellaneous			
Lights	14.5		
Base Utilities	0.0	0.00	
Misc Equipment	0.0	0.00	
Sub Total	14.5	96.37	
Grand Total	15.1	100.00	

D6-92

ESOS STUDY AT WSMR - BUILDING 1753
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO# 17)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

bibliosibisa

Air Density:

Air Specific Heat:

Density-Specific Heat Prod:

Latent Heat Factor:

Enthalpy Factor:

0.0653 (Lbm/cuft)

0.2444 (Btu/lbm/F)

(Btu-min./hr/cuft/F)

4,214.8 (Btu-min./hr/cuft)

3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:45:52 1/20/91
Dataset Name: 1753 .TM

D6-93

44444444444

System 1 Block UH - UNIT HEATERS

Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OAD8/WB/HR: 0/ 0/ 0.0 OADB: Ω OADB: 24 Net Percnt * Ret. Air Ret. Air Percnt * Space Space Space Peak Coil Peak Percnt Sens.+Lat. Sensible Latent Total Of Tot * Sensible Of Tot * Space Sens Tot Sens Of Tot (%) * Envelope Loads (Btuh) (8tuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr 0.00 * 0.00 0 0 0 0 0 0 0.00 Skylite Cond 0 0 0 0.00 0 0.00 * -80,459 -80,459 27.17 Roof Cond -53,321 0 0 0 0.00 0 0.00 * -53.321 18.00 Glass Solar 0 0.00 0.00 * 0 n n n 0.00 0 0 0 ٥ 0.00 Glass Cond Ω 0.00 * n 0 0.00 Wall Cond 0 ٥ ٥ 0.00 0 0.00 * -33,728 -33,728 11.39 Partition 0.00 0 0.00 * 0 0 0.00 0.00 * Exposed Floor 0 0 0.00 Ω -11,208 -11,208 3.78 Infiltration Λ O 0.00 * 0.00 0 -117,449 -117,449 39.66 Sub Total ==> 0 0 0.00 0.00 -296,165 0 0 -296,165 100.00 Internal Loads Lights O Ω 0.00 0.00 * Ð n 0 n 0.00 People 0 0 0.00 0 0.00 * 0 0.00 Misc 0.00 0 0.00 * 0 0 0.00 Sub Total ==> 0 0 0.00 * 0.00 0 0 0.00 0 Ceiling Load 0 0.00 * a n 0.00 0 0 0 0.00 Outside Air 0 O 0.00 0 0.00 * 0 0 0.00 Sup. Fan Heat 0 0.00 0.00 0 0.00 Ret. Fan Heat 0.00 * 0.00 0 0.00 Duct Heat Pkup 0 0.00 0.00 * 0 0.00 OV/UNDR Sizing 0 0.00 * 0.00 * 0 a 0 Exhaust Heat 0 0 0 0.00 * 0.00 * 0 Terminal Bypass n 0.00 0.00 * 0.00 Grand Total==> -296,165 0.00 * 0.00 * -296,165 100.00 -----COOLING COIL SELECTION------------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/KR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 14.360 Main Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 0 Part Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 365 Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 17,100 1.800 Totals 0.0 0.0 Wall 6,421 0 ------HEATING COIL SELECTION---------- AIRFLOWS (cfm)-------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Lvg Type Cooling Heating Clg % OA 0.0 Type Clg Hta (Mbh) (cfm) Deg F Deg F Vent 0 0 Clg Cfm/Sqft 0.00 SADB 0.0 93.8 -677.4 Main Htg 10,750 28.0 93.8 Infil 0 2,992 Clg Cfm/Ton 0.00 Plenum 0.0 65.0 Aux Htg 0.0 0 0.0 0.0 Supply 0 10,750 Clg Sqft/Ton 0.00 Return 0.0 65.0 Preheat 0.0 0 0.0 0.0 Mincfm 0 0 0.00 Clg Btuh/Sqft Ret/OA 0.0 65.0 Reheat 0.0 0 0.0 0.0 Return ٥ 10,750 No. People 0 0.0 Runarnd **Humidif** 0.0 0 0.0 0.0 Exhaust 0 0 Htg % OA 0.0 Fn MtrTD 0.0 0.1 Opt Vent 0.0 0.0 0.0 Rm Exh 0 0 Htg Cfm/SqFt 0.75 Fn BidTD 0.0 0.1 Total -677.4 Auxil 0 Htg Btuh/SqFt -47.17 Fn Frict 0.0 0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1
BASELINE BUILDING 1753

------AIRFLOW HEATING LOADS-----------------(At time of Coil Peak)

Ventilation Op. Vent Reheat Humidif													
Room		Airflow	Sensible	Airflow	Sensibl e	Airflow	Sensibl e	Airflow	Latent	Total			
Number	Description	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Btuh)			
1	HI-BAY AREA	0	0	0	0	0	0	0	0	0~			
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0			
Zone	1 Block	0	0	0	0	0	0	0	0	0			
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0			
System	1 Block	0	0	0	0	0	0	0	0	0			

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1753

(At time of Coil Peak)

			*************				- Heating	g		•••••			
			Supply	Return	System		System	Room			Run		System
			Fan	Fan	Exhaust		Exhaust	Exhaust	Ducted	Plenum	Around	Corridr	Return
Room			Heat	Heat	Heat Loss	Total	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow
Number	C	escription	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)
1	HI-BA	Y AREA	0	0	0	0	0	0	0	0	0	0	10,750
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	10,750
Zone	1	Block	0	0	0	0	0	0	0	0	0		10,750
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0		10,750
System	1	Block	0	0	0	0	0	0	0	0	0	0	•

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1753

------ BUILDING U-VALUES------

Room		*****			Room Mass (lb/	Room Capac.						
Number	Description		ExFlr									(Btu/ sqft/F)
1	HI-BAY AREA	0.000	0.750	1.000	1.091	0.085	0.000	0.000	0.128	0.000	23.7	5.23
Zone	1 Total/Ave.	0.000	0.750	1.000	1,091	0.085	0.000	0.000	0.128	0.000	23.7	5.23
System	1 Total/Ave.										23.7	5.23
Building	g	0.000	0.750	1.000	1.091	0.085	0.000	0.000	0.128	0.000	23.7	5.23

matamana

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1753



Room	Number of Duplicate	• •	Total Floor Area	Partition Area	Exposed Floor Area	Skylight Area	Skl /Rf	Net Roof Area	Window Area	Win /Wl	Net Wall Area
Number Description	Flr Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1 HI-BAY AREA	1 1	14,360	14,360	0	365	1,800	11	15,300	C	0	6,421
Zone 1 Total/Ave.			14,360	0	365	1,800	11	15,300	0	0	6,421
System 1 Total/Ave.			14,360	0	365	1,800	11	15,300	0	0	6,421
Building			14,360	0	365	1,800	11	15,300	0	0	6,421

ASHRAE 90 ANALYSIS - ALTERNATIVE 1
BASELINE BUILDING 1753

. 696

----- ASHRAE 90 ANALYSIS-----

Overall Roof U-Value = 0.181 (Btu/Hr/Sq Ft/F)
Overall Wall U-Value = 0.128 (Btu/Hr/Sq Ft/F)
Overall Building U-Value = 0.167 (Btu/Hr/Sq Ft/F)

Roof Overall Thermal Transfer Value (OTTVr) = 19.70 (Btu/Hr/Sq Ft)Wall Overall Thermal Transfer Value (OTTVw) = 5.93 (Btu/Hr/Sq Ft)

D6-96

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

System Totals

Percent	Cool	ing Loa	nd	Heati	ng Load		Cooling	Airflo		Heating	Airflow	,
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-33,869	8	88	537.5	0	0	0.0	0	0
5 - 10	0.0	0	0	-67 ,7 38	6	64	1,075.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-101,606	13	139	1,612.5	0	0	0.0	0	0
15 - 20	0.0	0	0	-135,475	17	178	2,150.0	0	0	0.0	0	. 0
20 - 25	0.0	0	0	-169,344	33	349	2,687.5	0	0	0.0	0	0
25 - 30	0.0	0	0	-203,213	23	240	3,225.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-237,082	0	0	3,762.5	0	0	0.0	0	0
35 - 40	0.0	0	0	-270,950	0	0	4,300.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-304,819	0	0	4,837.5	0	0	0.0	0	0
45 - 50	0.0	0	0	-338,688	0	0	5,375.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-372,557	0	0	5,912.5	0	0	0.0	0	0
55 - 60	0.0	0	0	-406,426	0	0	6,450.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-440,294	0	0	6,987.5	0	0	0.0	0	0
65 - 70	0.0	0	0	-474,163	0	0	7,525.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-508,032	0	0	8,062.5	0	0	0.0	0	0
75 - 80	0.0	0	0	-541,901	0	0	8,600.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-575,770	0	0	9,137.5	0	0	0.0	0	0
85 - 90	0.0	0	0	-609,639	0	0	9,675.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-643,507	0	0	10,212.5	0	0	0.0	0	0
95 - 100	0.0	0	0	-677,376	0	0	10,750.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,702	0.0	0	0	0.0	0	8,760

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------ MONTHLY ENERGY CONSUMPTION -----

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Ծերա/եր)
Jan	1,614	8	868	4
Feb	1,475	8	482	4
March	1,473	7	0	2
April	1,307	7	0	0
May	1,420	7	0	0
June	1,412	7	0	0
July	1,315	7	0	0
Aug	1,473	7	0	0
Sept	1,307	7	0	0
Oct	1,420	7	0	0
Nov	1,334	8	74	2
Dec	1,557	8	625	3
Total	17,107	8	2,049	4

Building Energy Consumption = 18,333 (Btu/Sq Ft/Year)
Source Energy Consumption = 18,774 (Btu/Sq Ft/Year)

Floor Area = 14,360 (Sq Ft)

તામકારાતાના

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

	PEAK	CHE	CKSUMS
Utility ELECTRIC DEMAND			
Peak Value 7.7 (kW) Yearly Time of Peak 9 (hr) 1 (mo)			
Hour 9 Month 1			
Sub Total		0.0	0.00
Heating Equipment			
1 EQ2201 GAS FIRED UNIT HEATER		0.5	6.51
Sub Total		0.5	6.51
Sub Total		0.0	0.00
Sub Total		ō.o	0.00
Miscellaneous			
Lights		7.2	93.49
Base Utilities		0.0	0.00
Misc Equipment		0.0	0.00
Sub Total		7.2	93.49
Grand Total		7.7	100.00

******************** TRACE 600 ANALYSIS

ESOS STUDY AT WSMR - BUILDING 1753 WHITE SANDS MISSILE RANGE NM US ARMY EMC ENGINEERS, INC. INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Weather File Code:

Location:

ELPASO.W

31.0 (deg)

Latitude: Longitude:

106.0 (deg)

Time Zone:

6

3,918 (ft)

Elevation: Barometric Pressure:

25.8 (in. Hg)

1.00

Summer Clearness Number: Winter Clearness Number:

1.00

Summer Design Dry Bulb:

98 (F)

Summer Design Wet Bulb:

64 (F)

Winter Design Dry Bulb:

Summer Ground Relectance:

24 (F)

Winter Ground Relectance:

0.20 0.20

Air Density:

0.0653 (Lbm/cuft)

Air Specific Heat:

0.2444 (Btu/lbm/F)

Density-Specific Heat Prod:

0.9575 (Btu-min./hr/cuft/F)

Latent Heat Factor:

4,214.8 (Btu-min./hr/cuft)

Enthalpy Factor:

3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May

To October

System Simulation Period: January To December

Cooling Load Methodology:

TETD/Time Averaging

Time/Date Program was Run: Dataset Name:

14:33:28 1/21/91 1753 .TM

System 1 Block RAD -	RADIATION
----------------------	-----------

Peaked a	t Time ==>	•	Mo/Hr:	0/0			*	Ho/	/Hr:	0/0 *	•	Mo/Hr	: 13/ 1	*****
Outside .	Air ==>	OA	DB/WB/HR:	0/ 0/ 0.	0		*	O.	ADB:	0	•	OADB	-	
		C====	Dag dim	Dan 43-	W - A		*	_						
		Space ens.+Lat.	Ret. Air Sensible			Percnt		•	oace	Percnt 1	•		il Peak	Percn
Envelope		(Btuh)	Sensible (Btuh)		Total	Of Tot		Sensi		Of Tot	•		ot Sens	Of To
Skylite		(6(01)	(6(41)	(Btuh)	(Btuh) O	(%) 0.00		(81	tuh)	(%)		tuh)	(Btuh)	(%
Skylit		0	0		0	0.00			0	0.00		0	0	0.0
Roof C		0	0		0	0.00			0	0.00 4			-72,719	27.2
Glass		0	0		0	0.00			0	0.00	,	0	-48,119 0	18.0
Glass		0	0		0	0.00			0	0.00		0		0.0
Wall Co		0	0		0	0.00			0	0.00			-70 /77	0.0
Partit		0	•		0	0.00			0	0.00	•	,437 O	-30,437 0	11.3
	d Floor	0			0	0.00			0	0.00				0.0
Infilt		0			0	0.00			0	0.00			-10,115	3.78
Sub To		0	0		0	0.00			0	0.00			105,991	39.6
Internal		•	•		·	3,50	*		v	5.00	- 201		267,381	100.00
Lights		0	0		0	0.00	*		0	0.00	•	0	0	0.00
People		0			0	0.00			0	0.00		0	0	0.00
Misc		0	0	0	0	0.00			0	0.00	,	0	0	0.00
Sub To	tal==>	0	0	0	0	0.00	*		0	0.00 *	1	0	0	0.00
Ceiling 1	Load	0	0		0	0.00	*		C	0.00 *	,	0	0	0.00
Outside /	Air	0	0	0	0	0.00	*		0	0.00 *	•	0	0	0.00
Sup. Fan	Heat				0	0.00	*			0.00 *	•		0	
Ret. Fan	Heat		0		0	0.00	*			0.00 *	,		0	
Duct Heat	t Pkup		0		0	0.00	*			0.00	,		0	0.00
OV/UNDR S	_	0			0	0.00	*		0	0.00	•	0	0	0.00
Exhaust I			0	0	0	0.00	*			0.00 *	•		0	0.00
Terminal	Bypass		0	0	0	0.00	*			0.00 *			0	0.00
		_	_				*			*	•			
Grand To	ta(==>	0	. 0	0	0	0.00	*		0	0.00 *	-267,	381 -	267,381	100.00
•••••			coo	LING COIL S	ELECTION	• • • • • • • •		••••				ARE	AS	••••••
	Total C	apacity	Sens Cap.	Coil Airfl	Enteri	ng DB/WB,	/HR	Leav	ing Di	B/WB/HR	Gross To	tal	Glass (s	f) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F Deg	F Gra	ins	Deg F	Deg F	Grains	Floor	14,360		
fain Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Part	0		
lux Clg	0.0	0.0	0.0	0	0.0	0.0 (0.0	0.0	0.0	0.0	Exflr	365		
opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	17,100	1,8	800 11
otals (0.0	0.0									Wall	6,421		0 0
	HEATING	COIL SEL	ECTION		AIF	RFLOWS (:fm)		1	ENGINEERING	CHECKS	TFM	PERATURE:	S (F)
		Coil A			Туре	Cooling		eating		g % OA	0.0	Тур		
	(Mbh)	(cf	m) Deg F	Deg F	Vent	0		0		g Cfm/Sqft	0.00	SADB	0.0	_
lain Htg	-252.0	1	0.0	0.0	Infil	0		2,992	*	g Cfm/Ton	0.00	Plenu		
lux Htg	0.0	1	0.0	0.0	Supply	0		. 0		g Sqft/Ton	0.00	Returi		
reheat	0.0	;	0.0	0.0	Mincfm	0		0		g Btuh/Sqft		Ret/O		
Reheat	0.0		0.0	0.0	Return	0		0		. People	0	Runari		
lumidif	0.0		0.0	0.0	Exhaust	0		0		3 % OA	0.0	Fn Mti		
· Gilli G I I														
pt Vent	0.0		0.0	0.0	Rm Exh	0		0	Ht	g Cfm/SqFt	0.00	Fn Blo	dTD 0.0	0.1

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2 INFRARED HEATERS - 1753

			Venti	ilation	Op.	Vent	Rel	heat	Hum	idif	
Room			Airflow	Sensibl e	Airflow	Sensible	Airflow	Sensible	Airflow	Latent	Total
Number	De	scription	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Btuh)
1	HI-BAY	AREA	0	0	0	0	0	0	0	0	0
Zone	1 T	otal/Ave.	0	0	0	0	0	0	0	0	0
Zone	1 B	lock	0	0	0	0	0	0	0	0	0
System	1 T	otal/Ave.	0	0	0	0	0	0	0	0	0
System	1 B	lock	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2 INFRARED HEATERS - 1753

------AIRFLOW HEAT GAIN AND LOSS-------(At time of Coil Peak)

							- Heating	g		• • • • • • •	• • • • • • • •		
			Supply	Return	System		System	Room			Run		System
			Fan	Fan	Exhaust		Exhaust	Exhaust	Ducted	Plenum	Around	Corridr	Return
Room			Heat	Heat	Heat Loss	Total	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow
Number	Đ	escription	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)
1	HI-BA	Y AREA	0	0	0	0	0	0	0	0	0	0	0
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone	1	Block	0	0	0	0	0	0	0	0	0	0	0
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
System	1	Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 2
INFRARED HEATERS - 1753

BUILDING U-VALUES-----

						Room Mass	Room Capac.						
Room					Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Desc	ription	Part.	Exflr	Skylt	Skylt	Roof	Windo	Windo	₩all	Ceil.	sqft)	sqft/F)
1	HI-BA	Y AREA	0.000	0.750	1.000	1.091	0.085	0.000	0.000	0.128	0.000	23.7	5.23
Zone	1	Total/Ave.	0.000	0.750	1.000	1.091	0.085	0.000	0.000	0.128	0.000	23.7	5.23
System	1	Total/Ave.	0.000	0.750	1.000	1.091	0.085	0.000	0.000	0.128	0.000	23.7	5.23
Buildin	g		0.000	0.750	1.000	1.091	0.085	0.000	0.000	0.128	0.000	23.7	5.23

BUILDING AREAS - ALTERNATIVE 2 INFRARED HEATERS - 1753

-----BUILDING AREAS-----

Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	/Rf	Wet Roof Area (sqft)	Window Area (sqft)	/WL	Net Wali Area (sqft)
1	HI-BAY AREA	1	1	14,360	14,360	0	365	1,800	11	15,300	0	0	6,421
Zone	<pre>1 Total/Ave.</pre>				14,360	0	365	1,800	11	15,300	0	0	6,421
System	1 Total/Ave.				14,360	0	365	1,800	11	15,300	0	0	6,421
Buildin	g				14,360	0	365	1,800	11	15,300	0	0	6,421

ASHRAE 90 ANALYSIS - ALTERNATIVE 2 INFRARED HEATERS - 1753

----- ASHRAE 90 ANALYSIS-----

Overall Roof U-Value = 0.181 (Btu/Hr/Sq Ft/F)
Overall Wall U-Value = 0.128 (Btu/Hr/Sq Ft/F)
Overall Building U-Value = 0.167 (Btu/Hr/Sq Ft/F)

Roof Overall Thermal Transfer Value (OTTVr) = 19.70 (Btu/Hr/Sq Ft)
Wall Overall Thermal Transfer Value (OTTVw) = 5.93 (Btu/Hr/Sq Ft)

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

System Totals

Percent	Cool	ing Loa	id	Heatir	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-12,600	2	13	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-25,200	8	59	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-37,800	.0	0	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-50,400	3	21	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-63,000	9	69	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-75,600	3	20	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-88,200	4	30	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-100,800	5	41	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-113,400	4	30	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-126,000	14	104	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-138,600	16	124	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-151,200	7	52	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-163,800	15	112	0.0	0	0	0.0	0	0
65 - 70	0.0	0	. 0	-176,400	12	93	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-189,000	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-201,600	0	0	0.0	0	0	0,0	0	0
80 - 85	0.0	0	0	-214,200	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-226,800	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	239,400	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-252,000	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,992	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

------ MONTHLY ENERGY CONSUMPTION ------

-	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	1,530	8	551	3
Feb	1,324	8	251	3
March	1,473	7	0	2
April	1,307	. 7	0	0
May	1,420	7	0	0
June	1,412	7	0	0
July	1,315	7	0	0
Aug	1,473	7	0	0
Sept	1,307	7	0	0
0ct	1,420	7	0	0
Nov	1,307	7	0	0
Dec	1,451	8	352	2
Total	16,738	8	1,154	3

Building Energy Consumption = Source Energy Consumption =

12,012 (Btu/Sq Ft/Year)
12,260 (Btu/Sq Ft/Year)

Floor Area =

14,360 (Sq Ft)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

Grand Total

U T 1 L 1 T Y	PEAK CHECKSUMS
Utility ELECTRIC DEMAND	
Peak Value 7.7 (kW) Yearly Time of Peak 9 (hr) 1 (mo)	
Hour 9 Month 1	
Sub Total	0.0 0.00
Heating Equipment	
1 EQ2201 GAS FIRED UNIT HEATER	0.5 6.51
Sub Total	0.5 6.51
Sub Total	0.0 0.00
Sub Total	0.0 0.00
Miscellaneous	
Lights	7.2 93.49
Base Utilities	0.0 0.00
Misc Equipment Sub Total	0.0 0.00
and locat	7.2 93.49

7.7 100.00

ESOS STUDY AT WSMR - BUILDING 1788
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO#17)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00

Winter Clearness Number: 1.00
Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 15:43:59 1/20/91 Dataset Name: 1788 .TM

System

Block

UH

- UNIT HEATERS

Peaked at	t Time ==	:>		Mo/Hr:	. (0/ 0				*	Mo	/Hr:	0/0 *		Mo/Hr:	13/ 1	
Outside /	\ir ==>		OAD	B/WB/HR:	:	0/ 0/ 0	.0			*	O/	WB:	0 *		OADB:	24	
		0-		2-4		B.4 43-				*			*				
		•	ace	Ret. /		Ret. Air			Percnt		•	oace	Percnt *	•		l Peak	Percnt
Envelope		iens.+La Btı)		Sensit		Latent			Of Tot		Sensi		Of Tot *	Space Se		t Sens	Of Tot
Skylite		(80)	0	(Btı	0	(Btuh)	(60	uh) O	(%) 0.00		(8)	tuh) O	,	,	Un) 0	(Btuh) O	(%)
Skylite			0		0			0	0.00			0	*****		0	0	0.00
Roof Co			0		0			0	0.00			0	0.00 ±		_	_	0.00
Glass			0		0			0	0.00			0	0.00 *		0	17,564 0	6,96
Glass			0		0			0				0			-	-	0.00
Wall Co			0		0			0	0.00			0	*****	-,		-8,605	3.41
Partit			0		U			-	0.00			_	0.00 *	•		39,333	55.21
			-					0	0.00			0	0.00 *		0	0	0.00
•	d Floor		0					0	0.00			0	0.00 *	•		12,115	4.80
Infilti			0		_			0	0.00			0	0.00 *	•		74,747	29.62
Sub To			0		0			0	0.00			0	0.00 *	•	565 -2	52,365	100.00
Internal	Loads		•		_			_		*		_	•		_	_	
Lights			0		0			0	0.00			0	0.00 *		0	0	0.00
People			0		_	_		0	0.00			0	0.00	1	0	0	0.00
Misc			0		0	0		0	0.00			0	0.00 *	1	0	0	0.00
Sub To			0		0	0		0	0.00			0	0.00 *	•	0	0	0.00
Ceiling			0		0			0	0.00			0	0.00		0	0	0.00
Outside /			0		0	0		0	0.00			0	0.00		0	0	0.00
Sup. Fan					_			0	0.00				0.00 *			0	
Ret. Fan					0			0	0.00				0.00 *			0	0.00
Duct Hear					0			0	0.00			_	0.00 *		_	0	0.00
OV/UNDR S	•		0		_	•		0	0.00			0	0.00 *		0	0	0.00
Exhaust					0	0		0	0.00				0.00			0	0.00
Terminal	вураss				0	0		0	0.00				0.00 *			0	0.00
Grand To	tal==>		0		0	0		0	0.00	*		0	0.00	-252,i	745 -2	52,365	100.00
di di di			•		٠	•		Ů	0.00			Ü	0.00	-232,	-2	72,303	100.00
						ING COIL				••••							
		Capaci		Sens Car	٠.	Coil Airf		-	DB/WB	-		-	B/WB/HR	Gross To		lass (si	f) (%)
	(Tons)	(Mb		(Mbh)		(cfm)	Deg F		F Gra		Deg F	-	Grains	Floor	9,520		
fain Clg	0.0		0.0	0.0		0		0.		0.0	0.0	0.0		Part	0		
lux Clg	0.0		0.0	0.0		0		0.		0.0	0.0	0.0		Exfir	394		
Opt Vent	0.0		0.0	0.0)	0	0.0	0.	.0	0.0	0.0	0.0	0.0	Roof	9,520		0 0
otals	0.0		0.0											Wall	6,006	1	167 3
	HEATIN	IG COIL	SELE	CTION	. .			-AIRF	LOWS (cfm)			ENGINEERING	CHECKS	TEMP	ERATURES	S (F)
	Capacit	у Со	il Ai	rfl Er	nt	Lvg	Type	C	ooling		Heating	Cl	g % OA	0.0	Туре		
	(Mbh))	(cfm) Deg	F	Deg F	Vent		0		. 0		g Cfm/Sqft	0.00	SADB		_
lain Htg	-464.	.5	8,8	100 39	8.9	95.0	Infil		0		1,904	ct	g Cfm/Ton	0.00	Plenum	0.0	
ux Htg	0.	.0		0 (0.0	0.0	Supply		0		8,800		g Sqft/Ton	0.00	Return	0.0	
reheat	0.	.0		0 (0.0	0.0	Mincfm		0		. 0		g Btuh/Sqft		Ret/OA		
Reheat	0.	.0		0 (0.0	0.0	Return		0		8,800		. People	0	Runarn		
lumidif	0.	.0		0 (0.0	0.0	Exhaust	:	0		0		g % OA	0.0	Fn Mtr		
	_	•											-				
Opt Vent	0.	.U		0 (0.0	0.0	Rm Exh		0		0	Ht	g Cfm/SqFt	0.92	Fn Bld	TD 0.0	0.1

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1788

----- BUILDING U-VALUES-----

		•••••			Roc	m U-Val	ues				Room	Room
					(Btu	/hr/sqf	t/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	HIGH BAY 1	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.603	0.000	65.2	13.93
2	HIGH BAY 2	0.000	0.000	0.000	0.000	0.045	1.140	1.259	0.564	0.000	69.6	14.82
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.582	0.000	67.4	14.38
System	<pre>1 Total/Ave.</pre>	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.582	0.000	67.4	14.38
Buildin	g	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.582	0.000	67.4	14.38

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1788

Room					er of icate	Floor Area/Dupl Room	Total Floor Area	Partition Area	Exposed Floor Area	Skylight Area	Skl /Rf	Net Roof Area	Window Area	Win /Wl	Net Wall Area
Number	Desc	rip	tion	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	HIGH	BAY	1 1	1	1	4,760	4,760	0	394	0	0	4.760	51	2	2,664
2	HIGH	BAY	1 2	1	1	4,760	4,760	0	0	0	0	4,760	115	4	3,176
Zone	1	To	otal/Ave.				9,520	0	394	0	0	9,520	167	3	5,840
System	1	To	otal/Ave.				9,520	0	394	0	0	9,520	167	3	5,840
Buildin	ng						9,520	0	394	0	0	9,520	167	3	5,840

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

System Totals

Percent	Cool	ing Loa	d	Heatir	ng Load		Cooling	Airflow		Keating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-23,224	19	466	440.0	0	a	0.0	n	n
5 · 10	0.0	0	0		18	426	880.0	0	0		•	0
		-	-	-46,449				_	0	0.0	0	Ü
10 - 15	0.0	0	0	-69,673	15	368	1,320.0	0	U	0.0	U	Ü
15 - 20	0.0	0	0	-92,897	18	427	1,760.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-116,122	16	3 85	2,200.0	0	0	0.0	0	0
25 ~ 30	0.0	0	0	-139,346	10	241	2,640.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-162,570	4	86	3,080.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-185,794	0	0	3,520.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-209,019	0	0	3,960.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-232,243	0	0	4,400.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-255,467	0	0	4,840.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-278,692	0	0	5,280.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-301,916	0	0	5,720.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-325,140	0	0	6,160.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-348,365	0	0	6,600.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-371,589	0	0	7,040.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-394,813	0	0	7,480.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-418,037	0	0	7,920.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-441,262	0	0	8,360.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-464,486	0	0	8,800.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,361	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

MONTHLY EN	NERGY	CONSUMPTION
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	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(k₩h)	(kW)	(Therm)	(Thrm/hr)
Jan	3,734	18	858	3
Feb	3,376	18	683	3
March	3,943	18	177	2
April	3,292	18	0	0
May	3,578	18	0	0
June	3,556	18	0	0
July	3,314	18	0	0
Aug	3,710	18	0	0
Sept	3,292	18	0	0
Oct	3,578	18	0	0
Nov	3,516	18	169	1
Dec	3,538	18	582	2
Total	42,426	18	2,469	3

Building Energy Consumption = 41,147 (Btu/Sq Ft/Year)
Source Energy Consumption = 41,949 (Btu/Sq Ft/Year)

Floor Area = 9,520 (Sq Ft)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

UTILITY	PEAK CHE	C K S U M S	•••••
Utility ELECTRIC DEMAND			
Peak Value 18.5 (kW) Yearly Time of Peak 9 (hr) 1 (mo)			
Hour 9 Month 1			
Sub Total	0.0	0.00	
Heating Equipment			
1 EQ2201 GAS FIRED UNIT HEATER	0.4	2.15	
Sub Total	0.4	2.15	
Sub Total	0.0	0.00	
Sub Total	0.0	0.00	
Miscellaneous			
Lights Base Utilities	18.1	97.85	
	0.0	0.00	
Misc Equipment	0.0	0.00	
Sub Total	18.1	97.85	
Grand Total	18.5	100.00	

ESOS STUDY AT WSMR - BUILDING 1788
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO #17)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00

Winter Clearness Number: 1.00

Summer Design Dry Bulb: 98 (F)

Summer Design Wet Bulb: 64 (F)

Winter Design Dry Bulb: 24 (F)

Summer Ground Relectance: 0.20

Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)

Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:49:29 1/21/91 Dataset Name: 1788 .TM

System 1 Block UH - UNIT HEATERS

Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: O OADB: 24 Ret. Air Ret. Air Space Net Percnt Space Percnt * Space Peak Coil Peak Percnt Sens.+Lat. Sensible Latent Total Of Tot Sensible Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr 0 0 0.00 0 0.00 0 0 0.00 Skylite Cond 0 0 0 0.00 0 0.00 0 0 0.00 Roof Cond 0.00 -15,851 0 0 Ω n 0.00 * -15,851 6.96 Glass Solar 0 0 0.00 0 0.00 0 0.00 Glass Cond 0 0 0 0.00 0.00 -7,769 0 -7,769 3.41 Wall Cond 0.00 * Ω 0 0 0.00 0 -125,740 -125,740 55.21 Partition 0 0.00 0 0.00 0 0 0.00 0.00 * Exposed Floor 0 0 0.00 n -10,933 -10,933 4.80 Infiltration n 0.00 0 0.00 * -67,454 -67,454 29.62 Sub Total ==> 0.00 0 0.00 -227,747 -227,747 100.00 Internal Loads O Lights Ω 0 0.00 0 0.00 * 0 0 0.00 People 0 0 0.00 0 0.00 0 0 0.00 Misc 0 0 0 0 0.00 0 0.00 0 0.00 Sub Total==> 0 0 O 0.00 0 0.00 0 0.00 Ceiling Load 0 0 0 0.00 0 0.00 O n 0.00 Outside Air O n n 0.00 n 0.00 U 0.00 Sup. Fan Heat 0 0.00 0.00 Ret. Fan Heat 0.00 0.00 0 Duct Heat Pkup 0 0 0.00 0.00 0 0.00 OV/UNDR Sizing 0 0 0.00 0 0.00 * 0 0.00 Exhaust Heat ۵ 0 0.00 0.00 0 0.00 Terminal Bypass 0 0 0.00 0.00 0.00 Grand Total ==> n 0.00 O 0.00 -227,747 -227,747 100.00 ------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR **Gross Total** Glass (sf) (%) (Mbh) (Tons) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 9.520 Main Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Part 0 Aux Clg 0.0 0.0 0.0 0 0.0 394 0.0 0.0 0.0 0.0 0.0 ExFlr Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 9,520 Roof 0 n Totals 0.0 0.0 Wall 6,006 167 ----- AIRFLOWS (cfm)------- ENGINEERING CHECKS---- TEMPERATURES (F)---Capacity Coil Airfl Ent Lva Type Cooling Heating Clg % OA 0.0 Type Clg Htg (Mbh) (cfm) Deg F Deg F Vent 0 0 Clg Cfm/Sqft 0.00 SADB 0.0 88.0 -200.0 8,800 Main Htg 64.3 88.0 Infil 0 1,904 Clg Cfm/Ton 0.00 Plenum 0.0 61.0 0.0 Aux Htg 0.0 0 0.0 Supply 0 8,800 Clg Sqft/Ton 0.00 Return 0.0 61.0 Preheat 0.0 0 0.0 0.0 Mincfm 0 0 Clg Btuh/Sqft 0.00 Ret/OA 0.0 61.0 Reheat 0.0 0 0.0 0.0 Return 0 8,800 No. People 0 Runarnd 0.0 61.0 Humidif 0.0 0.0 0.0 Exhaust 0 0 Htg % OA 0.0 Fn MtrTD 0.0 0.1 Opt Vent 0.0 0.0 0.0 Rm Exh 0 Htg Cfm/SqFt 0.92 Fn BldTD 0.0 0.1 Total -200.0 Auxil 0 Htg Btuh/SqFt -21.01 **Fn Frict** 0.0 0.2 BUILDING U-VALUES - ALTERNATIVE 2
INFRARED HEATERS - 1788

BUILDING U-VALUES-----

	Room U-Values											Room
					(Btu	/hr/sq1	t/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	HIGH BAY 1	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.603	0.000	65.2	13.93
2	HIGH BAY 2	0.000	0.000	0.000	0.000	0.045	1.140	1.259	0.564	0.000	69.6	14.82
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.582	0.000	67.4	14.38
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.582	0.000	67.4	14.38
Buildin	g	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.582	0.000	67.4	14.38

BUILDING AREAS - ALTERNATIVE 2 INFRARED HEATERS - 1788

BUILDING AREAS-----

Room Number	Descr	iption		er of icate Rm	Floor Area/Dupl Room (sqft)	Total- Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	/Rf	Net Roof Area (sqft)	Window Area (sqft)	/WL	Net Wall Area (sqft)
1	HIGH	BAY 1	1	1	4,760	4,760	. 0	394	0	0	4,760	51	2	2,664
2	HIGH	BAY 2	1	1	4,760	4,760	0	0	0	0	4,760	115	4	3,176
Zone	1	Total/Ave.				9,520	8	394	0	0	9,520	167	3	5,840
System	1	Total/Ave.				9,520	0	394	0	0	9,520	167	3	5,840
Buildin	g					9,520	0	394	0	0	9,520	167	3	5,840

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

System Totals

Percent	Cool	ing Loa	d	Heatir	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-10,000	12	191	440.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-20,000	6	103	880.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-30,000	8	122	1,320.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-40,000	4	61	1,760.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-50,000	7	114	2,200.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-60,000	7	115	2,640.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-70,000	10	154	3,080.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-80,000	8	126	3,520.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-90,000	12	190	3,960.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-100,000	10	163	4,400.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-110,000	4	70	4,840.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-120,000	6	90	5,280.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-130,000	5	87	5,720.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-140,000	2	29	6,160.0	0	0	0.0	0	0.
70 - 75	0.0	0,	0	-150,000	0	0	6,600.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-160,000	0	0	7,040.0	0	0	0.0	. 0	0
80 - 85	0.0	0	0	-170,000	0	0	7,480.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-180,000	0	0	7,920.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-190,000	. 0	0	8,360.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-200,000	0	0	8,800.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	7,145	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

------ MONTHLY ENERGY CONSUMPTION ------

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	3,742	18	556	2
Feb	3,310	18	410	2
March	3,758	18	29	1
April	3,292	18	0	0
May	3,578	18	0	0
June	3,556	18	0	0
July	3,314	18	0	0
Aug	3,710	18	0	0
Sept	3,292	18	0	0
Oct	3,578	18	0	0
Nov	3,320	18	30	1
Dec	3,564	18	339	2
Total	42,013	18	1,365	2

Building Energy Consumption = 29,401 (Btu/Sq Ft/Year) Source Energy Consumption = 29,844 (Btu/Sq Ft/Year)

9,520 (Sq Ft)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

UTILITY PEAK	CHECKS	UMS
Utility ELECTRIC DEMAND		
Peak Value 18.5 (kW) Yearly Time of Peak 9 (hr) 1 (mo)		
Hour 9 Month 1		
Sub Total	0.0 0.	.00
Heating Equipment		
1 EQ2201 GAS FIRED UNIT HEATER	0.4 2.	. 15
Sub Total	0.4 2.	. 15
Sub Total	0.0 0.	.00
Sub Total	0.0 0.	.00
Miscellaneous		
Lights	18.1 97.	.85
Base Utilities	0.0 0.	.00
Misc Equipment	0.0 0.	
Sub Total	18.1 97.	.85
Grand Total	18.5 100.	.00

V 60

PAGE 1

ELPASO.W

ESOS STUDY AT WSMR - BUILDING 1794
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.

Weather File Code:

Air Density:

INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Location:

Latitude: 31.0 (deg)

Longitude: 106.0 (deg)

Time Zone: 6

Elevation: 3,918 (ft)

Barometric Pressure: 25.8 (in. Eg)

Summer Clearness Number: 1.00

Winter Clearness Number: 1.00

Winter Clearness Number: 1.00
Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

Air Specific Heat:

Density-Specific Heat Prod:

Latent Heat Factor:

Enthalpy Factor:

0.2444 (Btu/lbm/F)

(Btu-min./hr/cuft/F)

(Btu-min./hr/cuft)

3.9171 (Lb-min./hr/cuft)

0.0653 (Lbm/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 8:48:15 1/20/92 Dataset Name: 1794 .TM

D6-121

System	1	Block	UH	-	UNIT HEATERS	
-1	_				A1.22 MM1777	

Discem	-	BIOCA	OH	- ONTI HE	MIERO									
					*****	******								*****
	t Time ==		Mo/Hr:	0/ 0	_		*			0/ 0 *		Mo/Hr:		
Outside	Air ==>	O.	ADB/WB/HR:	0/ 0/ 0.	0		*	0.	ADB:	0 *		CADB:	24	
		C	n 14-	. 7-4 34-		. .	*	_						
		Space Sens.+Lat.		Ret. Air		Percnt			pace	Percnt *	•		Peak	Percnt
Envalona			Sensible		Total	Of Tot		Sens		Of Tot *	Dpaco .		Sens	Of Tot
Envelope	e Solr	(Btuh)	(Btuh)	• •	(Btuh)	(\$)		(B	tuh)	(%) *	,		Stuh)	(%)
-	e Cond	0	(0	0.00			0	0.00 *		0	0	0.00
Roof C		0	(0	0.00			0	0.00 *		0	0	0.00
Glass		0	(0				0	0.00 *			,919	25.47
Glass		0	(0	0.00			0	0.00 *		0	0	0.00
Wall C		0				0.00			0	0.00 *			,117	15.08
Partit		_	,	,	0	0.00			0	0.00 *			,775	28.73
		0			0	0.00			0	0.00 *		0	0	0.00
-	d Floor	0			0	0.00			0	0.00 *	•		,850	2.58
Infilt Sub To		0		•	0	0.00			0	0.00 *			,406	28.14
		0	C)	0	0.00			0	0.00 *	•	067 -730	,067	100.00
Internal		•					*			*		_		
Lights		0	C	,	0	0.00			0	0.00 *		0	0	0.00
People Misc	1	0	c	. 0	0	0.00			0	0.00 *		0	0	0.00
Sub To	+-1	0	0		0	0.00			0	0.00 *		0	0	0.00
Ceiling		0	o o		0	0.00			0	0.00 *		0	0	0.00
Outside :		0	o o		0	0.00			٥	0.00 *		0	0	0.00
Sup. Fan		·			0	0.00			U	0.00 *		U	0	
Ret. Fan			o		0	0.00				0.00 *			0	0.00
Duct Hea			0		0	0.00				0.00 *			0	0.00
OV/UNDR	•	0	•		0	0.00			0	0.00 *		0	0	0.00
Exhaust	-	•	0	0	0	0.00			Ū	0.00 *		U	0	0.00
Terminal			0	-	0	0.00				0.00 *			0	0.00
	-15		_	•	·	0.00	*			*			٠	0.00
Grand To	tal==>	0	0	0	0	0.00	* -		0	0.00 *	-730,	067 -730	,067	100.00
											•		,	
			coo	LING COIL S	ELECTION							AREAS		
	Total	Capacity	Sens Cap.	Coil Airfl	Enteri	ng DB/WB,	/HR	Leav	ring DB	/WB/HR	Gross To	tal Gla	.ss (sf	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F Deg	F Gra	ins	Deg F	Deg F	Grains	Floor	17,441		
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Part	0		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	613		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	17,441		0 0
Totals	0.0	0.0									Wall	10,926	2,1	32 20
			ECTION		AI					NGINEERING		TEMPER		(F)
	Capacit	-		Lvg	Туре	Cooling	F	Reating	_	% CA	0.0	Type	Clg	Ħtg
W-4	(Mbh)	,	_	-	Vent	0		0	•	Cfm/Sqft	0.00	SADB	0.0	
Main Htg	-1,209.	•	075 41.3		Infil	0		5,232	_	Cfm/Ton	0.00	Plenum	0.0	65.0
Aux Htg	0.		0 0.0		Supply	0		21,075	_	Sqft/Ton	0.00	Return	0.0	
Preheat	0.		0 0.0		Mincfm	0		0	-	Btuh/Sqft		Ret/OA	0.0	
Reheat	0.		0 0.0		Return	0		21,075		People	0	Runarnd	0.0	65.0
Humidif Opt Vent	0.		0 0.0		Exhaust	0		0	-	% OA	0.0	Fn MtrTD		0.1
Total	-1 709		0 0.0	0.0	Rm Exh	0		0		Cfm/SqFt	1.21	Fn BldTD		0.1
*0.04	-1,209.	•			Auxil	0		0	Htg	Btuh/SqFt	-69.32	Fn Frict	0.0	0.2

V 600

PAGE 8

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1
BASELINE BUILDING 1794

			vent:	liation	Op.	vent	Re	neat	Hum	1d1f	
Room		•	Airflow	Sensible	Airflow	Sensible	Airflow	Sensible	Airflow	Latent	Total
Number		Description	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Btuh)
1	ROOM	1	0	0	0	0	0	0	0	. 0	0
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1	Block	0	0	0	0	0	0	0	0	0
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0
System	1	Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1794

							- Heating	g					
			Supply	Return	System		System	Room			Run		System
			Fan	Fan	Exhaust		Exhaust	Exhaust	Ducted	Plenum	Around	Corridr	Return
Room			Heat	Heat	Heat Loss	Total	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow
Number	D	escription	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)
1	ROOM	1	0	0		0	0	٥	0	0	0	0	21 075
•								U	·	U	U	U	21,075
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	21,075
Zone	1	Block	0	0	0	0	0	0	0	0	0	0	21,075
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	21,075
System	1	Block	0	0	0	0	0	0	0	0	0	0	21,075

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1794

----- BUILDING U-VALUES-----

						Room	Room						
Room										Mass (lb/	Capac. (Btu/		
Number	Desc	ription	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	ROOM	1	0.000	0.750	0.000	0.000	0.260	1.140	1.259	0.582	0.000	85.6	18.02
Zone	1	Total/Ave.	0.000	0.750	0.000	0.000	0.260	1.140	1.259	0.582	0.000	85.6	18.02
System	1	Total/Ave.	0.000	0.750	0.000	0.000	0.260	1.140	1.259	0.582	0.000	85.6	18.02
Buildin	g		0.000	0.750	0.000	0.000	0.260	1.140	1.259	0.582	0.000	85.6	18.02

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1794

Room			er of icate	Floor Area/Dupl Room	Total Floor Area	Partition Area	Exposed Floor Area	Skylight Area	Skl /Rf	Net Roof Area	Window Area	Win /Wl	Net Wall
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	ROOM 1	1	1	17,441	17,441	. 0	613	0	0	17,441	2,132	20	8,794
Zone	1 Total/Ave.				17,441	0	613	0	0	17,441	2,132	20	8,794
System	1 Total/Ave.				17,441	0	613	0	0	17,441	2,132	20	8,794
Buildin	g				17,441	0	613	0	0	17,441	2,132	20	8,794

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

SYSTEM LOAD PROFILE -----

System Totals

Percent	Cool	ing Load	d	Heatin	g Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
							4 052 8	•	•	0.0	0	0
0 - 5	0.0	0	0	-60,450	13	320	1,053.7	0	0			_
5 - 10	0.0	0	0	-120,900	15	393	2,107.5	O	0	0.0	0	0
10 - 15	0.0	0	0	-181,350	13	339	3,161.3	0	0	0.0	0	O
15 - 20	0.0	0	0	-241,800	15	379	4,215.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-302,250	18	449	5,268.8	0	0	0.0	0	0
25 - 30	0.0	0	0	-362,700	14	363	6,322.5	0	0	0.0	0	0
30 - 35	0.0	0	0	-423,150	9	238	7,376.3	0	0	0.0	0	0
35 - 40	0.0	0	0	-483,600	2	60	8,430.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-544,050	0	0	9,483.8	0	0	0.0	0	0
45 - 50	0.0	0	0	-604,500	0	0	10,537.5	0	0	0.0	0	0
50 - 55	0.0	0	0	-664,950	0	0	11,591.3	0	0	0.0	0	0
55 - 60	0.0	0	0	-725,400	0	0	12,645.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-785,850	0	0	13,698.8	0	0	0.0	0	0
65 - 70	0.0	0	0	-846,300	0	0	14,752.5	0	0	0.0	0	0
70 - 75	0.0	. 0	0	-906,750	0	0	15,806.3	0	0	0.0	0	0
75 ~ 80	0.0	0	0	-967,200	0	0	16,860.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-1,027,650	0	0	17,913.8	0	0	0.0	0	0
85 - 90	0.0	0	0	-1,088,100	0	0	18,967.5	0	0	0.0	0	0
90 - 95	0.0	0	0	-1,148,550	0	0	20,021.3	0	0	0.0	0	0
95 - 100	0.0	0	0	-1,209,000	0	0	21,075.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,219	0.0	o	0	0.0	0	8,760



MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

----- MONTHLY ENERGY CONSUMPTION -----

	ELEC	DEMAND	GAS	GAS DMIND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	5,886	28	2,835	8
Feb	5,323	28	2,207	8
March	5,819	28	579	4
April	4,984	27	0	0
May	5,416	27	0	0
June	5,383	27	0	0
July	5,016	27	0	0
Aug	5,616	27	0	0
Sept	4,984	27	0	0
Oct	5,416	27	0	0
Nov	5,303	28	711	4
Dec	5,596	28	2,049	7
Total	64,742	28	8,381	8

60,725 (Btu/Sq Ft/Year) Building Energy Consumption = 62,212 (Btu/Sq Ft/Year) Source Energy Consumption =

Floor Area = 17,441 (Sq Ft) UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

 U T T T T T Y	PEAK	CRECKSUMS	

Utility ELECTRIC DEMAND

Peak Value 28.3 (kW)

Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

 Sub Total
 0.0
 0.00

Heating Equipment

1		EQ2201	GAS F	IRED	UNIT	HEATER	l		0.9	3.18
Sub	Total								0.9	3.18
Sub	Total								0.0	0.00
Sub	Total								0.0	0.00

Miscellaneous

Lights	27.4	96.82
Base Utilities	0.0	0.00
Misc Equipment	0.0	0.00
Sub Total	27.4	96.82
	•	
Grand Total	28.3	100.00

ESOS STUDY AT WSMR - BUILDING 1794
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Weather File Code: ELPASO.W
Location:
Latitude: 31.0 (deg)
Longitude: 106.0 (deg)
Time Zone: 6
Elevation: 3,918 (ft)
Barometric Pressure: 25.8 (in. Hg)
Summer Clearness Number: 1.00

Summer Clearness Number: 1.00
Winter Clearness Number: 1.00
Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)

Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 4:40:22 1/21/92 Dataset Name: 1794 .TM

System 1 Block RAD - RADIATION

	nt Time ==		TOP DATEOC.	L PEAK **** 0/ 0				*			0/ 0 4	,			*****
Outside			ADB/WB/HR:	0/ 0/ 0	.0			*		ADB:	0 1	•		: 13/ 1 : 24	
								*			•	•		•	
		Space	Ret. Ai	r Ret. Air	I	Net I	Percnt	*	S	pace	Percnt *	Space (Peak Co	il Peak	Percnt
	\$	Sens.+Lat.	Sensibl	e Latent	To	tal (Of Tot	*	Sens	ible	Of Tot	Space S	Sens To	ot Sens	Of Tot
Envelope	Loads	(Btuh)	(Btuh) (Btuh)	(Bt	uh)	(%)	*	(B	tuh)	(%)	' (B	tuh)	(Btuh)	(%)
Skylit	e Solr	0	1	0		0	0.00	*		0	0.00	•	0	0	0.00
Skylit	e Cond	0	1	0		0	0.00	*		0	0.00	•	0	0	0.00
Roof C	ond	0	1	0		0	0.00	*		0	0.00	-167	,780 -	167,780	25.46
Glass	Solar	0	ĺ	0		0	0.00	*		0	0.00	•	0	0	0.00
Glass	Cond	0	1	0		0	0.00	*		0	0.00	-99	,422 -	99,422	15.09
Wall C	ond	0	1	0		0	0.00	*		0	0.00	-189	,309 -	189,309	28.73
Partit	ion	0				0	0.00	*		0	0.00		0	0	0.00
Expose	d Floor	0				0	0.00	*		0	0.00	-17,	,011 -	17,011	2.58
Infilt	ration	0				0	0.00	*		0	0.00	-185		185,366	28.13
Sub To	tal==>	0	1	0		0	0.00	*		0	0.00			58,888	100.00
Internal	Loads							*			1		•	•	
Lights	;	0	1	0		0	0.00	*		0	0.00	•	0	0	0.00
People	•	0				0	0.00	*		0	0.00	•	0	0	0.00
Misc		0	(0 0		0	0.00	*		0	0.00	•	0	0	0.00
Sub To	tal==>	0	(0 0		0	0.00	*		0	0.00	•	0	0	0.00
Ceiling	Load	0	(0		0	0.00	*		0	0.00	•	0	0	0.00
Outside	Air	0	(0 0		0	0.00	*		0	0.00	,	0	0	0.00
Sup. Fan	Heat					0	0.00	*			0.00	,		0	
Ret. Fan	Heat		1	0		0	0.00	*			0.00 *	,		0	0.00
Duct Hea	t Pkup		(0		0	0.00	*			0.00	,		0	0.00
OV/UNDR	Sizing	0				0	0.00	*		0	0.00	,	0	0	0.00
Exhaust	Keat '		(0 0		0	0.00	*			0.00 *	,		0	0.00
Terminal	Bypass		(0 0		0	0.00	*			0.00 *	,		0	0.00
								*			*	,			
Grand To	tal==>	0	(0 0		0	0.00	*		0	0.00 *	-658,	,888 -6	558,888	100.00
· • • • • • • • • •			·co	OLING COIL	SELECTION-				• • • • • • •		•••••		ARE <i>A</i>	ıs	••••••
	Total	Capacity	Sens Cap.	Coil Airf	l Ente	ering	DB/WB/	HR	Lea	ving D	B/WB/HR	Gross To	otal (lass (s	f) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F	Deg F	Grai	ns	Deg F	Deg F	Grains	Floor	17,441		
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0	.0	0.0	0.0	0.0	Part	0		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0) 0	.0	0.0	0.0	0.0	ExFlr	613		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0	.0	0.0	0.0	0.0	Roof	17,441		0 0
Totals	0.0	0.0										Wall	10,926	2,	132 20
·	HEATIN	G COIL SEI	ECTION			AIRFL	.OWS (c	fm)			ENGINEERING	CHECKS	TFMP	FRATURE	S (F)
	Capacit				Type		ooling		eating		g % OA	0.0	Type		
	(Mbh)	-		_	Vent		0		0		g Cfm/Sqft	0.00	SADB	0.0	_
Main Htg	-700.		0 0.0	_	Infil		0		5,232		g Cfm/Ton	0.00	Plenum		
Aux Htg	0.	0	0 0.0		Supply		0		0		g Sqft/Ton	0.00	Return		
Preheat	0.		0 0.0		Mincfm		0		0		g Btuh/Sqft		Ret/OA		
Reheat	0.		0 0.0		Return		0		0		. People	0	Runarr		
Humidif	0.		0 0.0		Exhaust		0		0		g % OA	0.0	Fn Mtr		
Opt Vent	0.		0 0.0		Rm Exh		0		0		g Cfm/SqFt	0.00	Fn Blo		
Total	-700.				Auxil		0		0		g Btuh/SqFt		fn Fri		
							-		•						٠

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2
INFRARED HEATERS - 1794

			vent	ilation	op.	vent	Re	neat	Hum	idif	
Room			Airflow	Sensible	Airflow	Sensible	Airflow	Sensibl e	Airflow	Latent	Total
Number		Description	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Btuh)
1	ROOM	1	0	0	0	0	0	0	0	0	0
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1	Block	0	0	0	0	0	0	0	0	0
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0
System	1	Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2 INFRARED HEATERS - 1794

				• • • • • • • • • • • • • • • • • • • •			- Heating	g					
			Supply	Return	System		System	Room			Run		System
			Fan	Fan	Exhaust		Exhaust	Exhaust	Ducted	Plenum	Around	Corridr	Return
Room			Heat	Heat	Heat Loss	ĩotal	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow
Number	C	escription	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)
1	ROOM	1	0	0	0	0	0	0	0	0	0	0	0
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0	. 0	0
Zone	1	Block	0	0	0	0	0	0	0	0	0	0	0
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
System	1	Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 2 INFRARED HEATERS - 1794

	Room U-Values (Btu/hr/sqft/F)												Room Capac.
Room					Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Desc	ription	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	ROOM	1	0.000	0.750	0.000	0.000	0.260	1.140	1.259	0.582	0.000	85.6	18.02
Zone	1	Total/Ave.	0.000	0.750	0.000	0.000	0.260	1.140	1.259	0.582	0.000	85.6	18.02
System	1	Total/Ave.	0.000	0.750	0.000	0.000	0.260	1.140	1.259	0.582	0.000	85.6	18.02
Building	3		0.000	0.750	0.000	0.000	0.260	1.140	1.259	0.582	0.000	85.6	18.02

BUILDING AREAS - ALTERNATIVE 2 INFRARED HEATERS - 1794

------ BUILDING AREAS -----

Room Number	Descr	iption		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	/Rf	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1 Zone	ROOM 1	1 Total/Ave.	1	1	17,441	17,441 17,441	0	613 613	0	0	17,441 17,441	2,132 2,132	20 20	8,794 8,794
System Buildin	1 g	Total/Ave.				17,441 17,441	0	613 613	0 0	0	17,441 17,441	2,132 2,132	20 20	8,794 8,794

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

SYSTEM LOAD PROFILE-----

System Totals

Percent	Cool	ing Loa	d	Heatir	g Load	• • • • • • •	Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-35,000	7	123	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-70,000	10	186	0.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-105,000	11	194	0.0	0	0	0.0	. 0	0
15 - 20	0.0	0	0	-140,000	7	121	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-175,000	10	179	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-210,000	7	137	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-245,000	12	228	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-280,000	10	182	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-315,000	12	211	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-350,000	8	149	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-385,000	6	109	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-420,000	1	10	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-455,000	0	0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-490,000	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-525,000	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	~560,000	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-595,000	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-630,000	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-665,000	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-700,000	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,931	0.0	0	8,760	0.0	0	8.760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

------ MONTHLY ENERGY CONSUMPTION -----

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	5,470	20	1 905	
	•	28	1,895	6
Feb	4,963	28	1,344	6
March	5,676	28	116	3
April	4,984	27	0	0
May	5,416	27	0	0
June	5,383	27	0	0
July	5,016	27	0	0
Aug	5,616	27	0	0
Sept	4,984	27	0	0
Oct	5,416	27	0	0
Nov	5,028	28	191	3
Dec	5,188	28	1,196	5
Total	63,140	28	4,742	6

Building Energy Consumption = Source Energy Consumption =

39,543 (Btu/Sq Ft/Year) 40,384 (Btu/Sq Ft/Year)

Floor Area =

17,441 (Sq Ft)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

U T I L I T Y	PEAK CHEC	KSUMS	
Utility ELECTRIC DEMAND			
Peak Value 27.8 (kW) Yearly Time of Peak 9 (hr) 1 (mo)			
Hour 9 Month 1			
Sub Total	0.0	0.00	
Heating Equipment			
1 EQ2201 GAS FIRED UNIT HEATER	0.4	1.34	
Sub Total	0.4	1.34	
Sub Total	0.0	0.00	
Sub Total	0.0	0.00	
Miscellaneous			
Lights	27.4	98.66	
Base Utilities	0.0	0.00	
Misc Equipment	0.0	0.00	
Sub Total	27.4	98.66	
Grand Total	27.8	100.00	

Weather File Code:

ESOS STUDY AT WSMR - BUILDING 1827
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO*17)

ELPASO.W

Location: 31.0 (deg) Latitude: Longitude: 106.0 (deg) Time Zone: 3,918 (ft) Elevation: 25.8 (in. Hg) Barometric Pressure: 1.00 Summer Clearness Number: Winter Clearness Number: 1.00 98 (F) Summer Design Dry Bulb: 64 (F) Summer Design Wet Bulb: Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20 0.0653 (Lbm/cuft) Air Density: Air Specific Heat: 0.2444 (Btu/lbm/F) Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft) Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14: 9:55 1/19/92 Dataset Name: 1827. .TM

Tstat = 65°F

Trane Air Conditioning Economics By: Trane Customer Direct Service Network

PAGE

System	1	Block	UH	-	UNIT	HEATERS

******	******	***** C	OOLING COIL	PEAK ****	******	******	****	**** CLG	SPACE	PEAK ****	***** HE	ATING COIL	PEAK *	*****
Peaked at	Time ==>		Mo/Hr: (0/ 0			*	Mo/	Hr:	0/0 *		Mo/Hr: 1	3/ 1	
Outside A	ir ==>	OA	DB/WB/HR:	0/ 0/ 0.	0		*	O.F	DB:	0 *		OADB:	24	
		Space	Ret. Air	Ret. Air	Net	. Percni	. *	St	ace	Percnt *	Space P	eak Coil	Peak	Percnt
	Sen	s.+Lat.	Sensible	Latent	Total			Sensi		Of Tot *	Space S			Of Tot
Envelope		(Btuh)	(Btuh)	(Btuh)	(Btuh)		* (tuh)	(%) ★	(Bt		tuh)	(%)
Skylite		0	0	•		0.00	, *	•	0	0.00 *	,	0	0	0.00
Skylite	Cond	0	0		c	0.00	* (0	0.00 *		0	0	0.00
Roof Co.	nd	0	0		(0.00) *		0	0.00 *	-116,	407 -116	,407	27.39
Glass S	olar	0	0		C	0.00	* (0	0.00 *		0	0	0.00
Glass C	ond	0	0		(0.00) *		0	0.00 *	-18,	247 -18	,247	4.29
Wall Co	nd	0	0		(0.00	* (0	0.00 *	-158,	930 -158	,930	37.39
Partiti	on	0			(0.00	* (0	0.00 *		0	0	0.00
Exposed	Floor	0			(0.00	* (0	0.00 *	-19,	988 -19	,988	4.70
Infiltr	ation	0			(0.00) *		0	0.00 *	-111,	460 -111	,460	26.22
Sub Tot	al==>	0	0		C	0.00	* (0	0.00 *	-425,	032 -425	,032	100.00
Internal	Loads						*			*				
Lights		0	0		(0.00	* (0	0.00 *		0	0	0.00
People		0			(0.00	* (0	0.00 *		0	0	0.00
Misc		0	0	0	(0.00	* (0	0.00 *		0	0	0.00
Sub Tot	al==>	0	0	0	(0.00	* (0	0.00 *		0	0	0.00
Ceiling L	oad	0	0		(0.00	* (0	0.00 *		0	0	0.00
Outside A	ir	0	Ó	0	(0.00	* (0	0.00 *		0	0	0.00
Sup. Fan	Heat				(0.00	* 0			0.00 *			0	0.
Ret. Fan	Heat		0		(0.00	* (0.00 *			0	0.
Duct Heat	Pkup		0		(0.00	*			0.00 *			0	0.00
OV/UNDR S	izing	0			(0.00	*		0	0.00 *		0	0	0.00
Exhaust H	leat		0	0	(0.00				0.00 *			0	0.00
Terminal	Bypass		0	0	(0.00) * *			0.00 *			0	0.00
Grand Tot	al==>	0	0	0	(0.00	, *		0	0.00 *	-425,	032 -425	,032	100.00
			COO	LING COIL S	ELECTION							areas-		
	Total Ca		Sens Cap.	Coil Airfl		ing DB/WI				B/WB/HR	Gross To	tal Gla	ss (sf) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	eg F Gra	ains	Deg F	Deg F	Grains	Floor	14,196		
Main Clg	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	Part	0		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	650		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	14,196		0 0
Totals	0.0	0.0									Wall	10,534	3	53 3
	HEATING	COIL SEL	ECTION		A	IRFLOWS	(cfm)			ENGINEERING	CHECKS	TEMPER	atures	(F)
	Capacity	Coil A	irfl Ent	Lvg	Туре	Coolin	g	Heating	Cl	g % OA	0.0	Туре	Clg	Htg
	(Mbh)	(cf	m) Deg F	Deg F	Vent		0	0	Cl	g Cfm/Sqft	0.00	SADB	0.0	98.6
Main Htg	-788.0	. 13,		98.6	Infil	1	0	2,839	Cl	g Cfm/Ton	0.00	Plenum	0.0	
Aux Htg	0.0		0.0	0.0	Supply		0	13,200		g Sqft/Ton	0.00	Return	0.0	
Preheat	0.0		0 0.0		Mincfm		0 ,	0		g Btuh/Sqft		Ret/OA	0.0	
Reheat	0.0		0 0.0		Return		0	13,200		. People	0	Runarnd	0.0	
Humidif	0.0		0 0.0		Exhaust		0	0		g % OA	0.0	Fn MtrTD		
Opt Vent	0.0		0 0.0	0.0	Rm Exh		0	0		g Cfm/SqFt		Fn BldTD		
Total	-788.0				Auxil		0	0	Ht	g Btuh/SqFt	-55.51	Fn Frict	0.0	0.2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1 BASELINE BUILDING 1827

(At time of Coil Peak)

Ventilation Op. Vent Reheat Humidif												
Room		Airflow	Sensible	Airflow	Sensible	Airflow	Sensible	Airflow	Latent	Total		
Number	Description	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Btuh)		
1	1ST FLOOR	. 0	0	0	0	0	0	Ó	0	0		
Zone	<pre>1 Total/Ave.</pre>	0	0	0	0	0	0	0	0	0		
Zone	1 Block	0	0	0	0	0	0	0	0	0		
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0		
System	1 Block	0	0	0	0	0	0	0	O	0		

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1827

------ AIRFLOW HEAT GAIN AND LOSS------ AIRFLOW HEAT GAIN AND

							- Heating	y					
			Supply	Return	System		System	Room			Run		System
			Fan	Fan	Exhaust		Exhaust	Exhaust	Ducted	Plenum	Around	Corridr	Return
Room			Heat	Heat	Heat Loss	Total	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow
Number	E	escription	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)
1	1ST F	LOOR	0	0	0	0	0	0	0	.0	0	0	13,200
Zone	1	Total/Ave.	0	0	o	0	0	0	0	0	0	0	13,200
Zone	1	Block	0	0	0	0	0	0	0	0	0	0	13,200
System	1	Total/Ave.	0	0	o	o	0	0	0	0	0	0	13,200
System	1	Block	o	0	0	0	0	0	0	o	0	0	13,200

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1827

------ BUILDING U-VALUES------

						Roc	m U-Val	ues				Room	Room
						(Btu	/hr/sqf	t/F)				Mass	Capac.
Room					Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Desc	ription	Part.	ExFlr	Skylt	Skylt	Roof	.Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST F	LOOR	0.000	0.750	0.000	0.000	0.200	1.140	1.259	0.381	0.000	94.4	19.77
Zone	1	Total/Ave.	0.000	0.750	0.000	0.000	0.200	1.140	1.259	0.381	0.000	94.4	19.77
System	1	Total/Ave.	0.000	0.750	0.000	0.000	0.200	1.140	1.259	0.381	0.000	94.4	19.77
Buildin	g		0.000	0.750	0.000	0.000	0.200	1.140	1.259	0.381	0.000	94.4	19.77

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1827

BUILDING AREAS

				Floor	Total		Exposed						
		Numb	er of	Area/Dupl	Floor	Partition	Floor	Skylight	sk1	Net Roof	Window	Win	Net Wall
Room		Dupl	icate	Room	Area	Area	Area	Area	/Rf	Area	Area	/W1	Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	1ST FLOOR	1	1	14,196	14,196	0	650	0	0	14,196	353	3	10,180
Zone	1 Total/Ave	•			14,196	0	650	0	0	14,196	353	3	10,180
System	1 Total/Ave	•			14,196	0	650	0	0	14,196	353	3	10,180
Buildin	g				14,196	0	650	0	0	14,196	353	3	10,180

System Totals

Percent	Cool	ing Loa	d	Heatin	g Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(*)		(Cfm)	(%)	
0 - 5	0.0	0	0	-39,398	9	241	660.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-78,797	18	483	1,320.0	0	0	0.0	0	0
10 - 15	0.0	0	0	-118,195	20	561	1,980.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-157,594	19	515	2,640.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-196,992	15	423	3,300.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-236,390	13	350	3,960.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-275,789	7	180	4,620.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-315,187	0	0	5,280.0	0	٥	0.0	0	0
40 - 45	0.0	0	0	-354,586	0	0	5,940.0	0	0	0.0	0	0
45 - 50	0.0	0	0	~393,984	0	0	6,600.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-433,382	0	0	7,260.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-472,781	0	0	7,920.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-512,179	0	0	8,580.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-551,578	0	0	9,240.0	0	0	0.0	· 0	0
70 - 75	0.0	0	0	-590,976	. 0	0	9,900.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-630,374	0	0	10,560.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-669,773	0	0	11,220.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-709,171	0	0	11,880.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-748,570	0	0	12,540.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-787,968	0	0	13,200.0	100	8,760	0.0	0	C
Hours Off	0.0	0	8,760	o	0	6,007	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	2,285	10	1,856	5
Feb	2,066	10	1,405	5
March	2,304	10	299	2
April	1,757	10	0	0
May	1,909	10	0	0
June	1,898	10	0	0
July	1,768	10	0	0
Aug	1,980	10	0	0
Sept	1,757	10	0	0
Oct	1,909	10	0	0
Nov	2,078	10	559	3
Dec	2,215	10	1,410	4
Total	23,927	10	5,530	5

Building Energy Consumption = Source Energy Consumption =

44,705 (Btu/Sq Ft/Year) 45,910 (Btu/Sq Ft/Year)

Floor Area =

14,196 (Sq Ft)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

 U T I L I T Y	PEAK	снескѕимѕ	

0.0

0.0

0.00

0.00

9.7 94.15

10.3 100.00

Utility ELECTRIC DEMAND

Peak Value 10.3 (kW) Yearly Time of Peak 9 (hr) 1 (mo)

Base Utilities

Misc Equipment

Sub Total

Grand Total

Hour 9 Month 1		
Sub Total	0.0	0.00
Heating Equipment		
1 EQ2201 GAS FIRED UNIT HEATER	0.6	5.85
Sub Total	0.6	5.85
Sub Total	0.0	0.00
Sub Total	0.0	0.00
Miscellaneous		
Lights	9.7	94.15

PAGE 1

ESOS STUDY AT WSMR - BUILDING 1827
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (ECO#17)

Weather File Code: ELPASO.W Location: 31.0 (deg) Latitude: 106.0 (deg) Longitude: Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 6:41:52 1/21/92
Dataset Name: 1827 .TM

Tstat=61°F

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

Preheat

Reheat

Humidif

Opt Vent

Total

0.0

0.0

0.0

0.0

-349.5

0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

Mincfm

Return

Exhaust

Rm Exh

Auxil

System 1 Block RAD - RADIATION

Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Peaked at Time ==> OADB: 24 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: 0 Space Peak Coil Peak Space Ret. Air Ret. Air Net Percnt * Space Percnt * Percnt Total Of Tot Space Sens Sens.+Lat. Sensible Latent Sensible Of Tot * Tot Sens (%) (Btuh) (%) * (Btuh) (Btuh) (%) Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) 0.00 * 0 0 0.00 Skylite Solr 0 0 0 0.00 Ω 0.00 * 0.00 Skylite Cond 0 0 0 0.00 0 0 0 0.00 0 0.00 * -105,050 -105,050 27.39 Roof Cond 0 0 0 0.00 0.00 * 0 . 0 0.00 Glass Solar Ω 0 ۵ 0 -16,475 Glass Cond 0 0.00 0 0.00 * -16,475 4.30 Wall Cond 0 0.00 0 0.00 * -143,425 -143,425 37.39 O n 0.00 n 0.00 * Ω . 0 0.00 Partition Exposed Floor 0 0 0.00 0 0.00 * -18,037 -18,037 4.70 Infiltration 0.00 0.00 -100,586 -100,586 26.22 0 0.00 0.00 * -383,574 -383,574 100.00 Sub Total ==> 0 0 Internal Loads 0 0.00 0.00 * 0 ٥ 0.00 Lights People 0 0.00 0 0.00 * 0 0.00 a 0.00 0 0.00 * 0 0.00 Misc Ω O Ω 0.00 * 0 0.00 * 0.00 Sub Total==> 0 0 O 0 Ceiling Load 0 0 0.00 0 0.00 * 0 0.00 Outside Air 0 0 0.00 0.00 * 0 0.00 Sup. Fan Heat 0 0.00 0.00 0.00 * n n 0.00 * O 0.7 Ret. Fan Heat Duct Heat Pkup 0.00 * 0.00 * 0.00 OV/UNDR Sizing 0.00 0.00 0.00 Exhaust Heat 0 0 0.00 0.00 0.00 Terminal Bypass 0 0.00 0.00 0.00 n Grand Total==> 0.00 * 0.00 -383,574 -383,574 100.00 -----AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 14,196 Main Cla 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Part 0 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Exfir 650 Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 14,196 0 0 Totals 0.0 Wall 10,534 353 -----AIRFLOWS (cfm)------- ENGINEERING CHECKS---- TEMPERATURES (F) ---Heating Capacity Coil Airfl Lva Type Cooling Clg % OA 0.0 Type Clg (Mbh) (cfm) Deg F Deg F Vent 0 0 Clg Cfm/Sqft 0.00 SADB 0.0 61.1 -349.5 0.0 0 Main Htg 0 0.0 Infil 2,839 Clg Cfm/Ton 0.00 Plenum 0.0 61.0 Aux Htg 0.0 0 0.0 0.0 Supply 0 0 Clg Sqft/Ton 0.00 Return 0.0 61.0

0

0

0

Ω

۵

0

Clg Stuh/Sqft

Htg Cfm/SqFt

Htg Btuh/SqFt

No. People

Htg % OA

0.00

0.0

0.00

-24.62

0

Ret/OA

Runarnd

Fn MtrTD

Fn BldTD

Fn Frict

0.0

0.0

0.0

0.0

61.0

61.0

0.1

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2
INFRARED HEATERS - 1827

(At time of Coil Peak)

			Vent	ilation	Op.	Vent	Re	heat	Hum	idif	
Room Number		Description	Airflow (Cfm)	Sensible (Btuh)		Sensible (Btuh)	Airflow (Cfm)	Sensible (Btuh)	Airflow (Cfm)	Latent (Btuh)	Total (Btuh)
1	1ST F	LOOR	0	0	0	0	0	0	0	0	0
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0
Zone	1	Block	0	0	0 -	0	0	0	0	0	0
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0
System	1	Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2 INFRARED HEATERS - 1827

			*******			*****	- Heating	g				·	
			Supply	Return	System		System	Room			Run		System
			Fan	Fan	Exhaust		Exhaust	Exhaust	Ducted	Plenum	Around	Corridr	Return
Room			Heat	Heat	Heat Loss	Total	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow
Number		escription	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)
1	1ST F	LOOR	0	0	0	0	0	0	0	0	0	0	0
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone	1	Block	0	0	0	0	0	0	0	0	0	0	0
System	1	Total/Ave。	0	0	0	0	0	0	0	0	0	0	0
System	1	Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 2
INFRARED HEATERS - 1827

------ BUILDING U-VALUES-----

			****			Roc (Btu	m U-Val ı/hr/sqf				•••••	Room Mass	Room Capac.
Room Number	Desc	ription	Part.	ExFlr	Summr Skylt	Wintr Skylt	Roof	Summr Windo	Wintr Windo	Wall	Ceil.	(lb/ sqft)	(Btu/sqft/F)
1	1ST F	FLOOR	0.000	0.750	0.000	0.000	0.200	1.140	1.259	0.381	0.000	94.4	19.77
Zone	1	Total/Ave.	0.000	0.750	0.000	0.000	0.200	1.140	1.259	0.381	0.000	94.4	19.77
System	1	Total/Ave.	0.000	0.750	0.000	0.000	0.200	1.140	1.259	0.381	0.000	94.4	19.77
Building	g		0.000	0.750	0.000	0.000	0.200	1.140	1.259	0.381	0.000	94.4	19.77

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

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BUILDING AREAS - ALTERNATIVE 2 INFRARED HEATERS - 1827

Room				ber of licate	Floor Area/Dupl Room	Total Floor Area	Partition Area	Exposed Floor Area	Skylight Area	Skl /Rf	Net Roof Area	Window Area	Win /WL	Net Wall Area
Number	Desc	ription	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	1ST	FLOOR	1	1	14,196	14,196	0	650	0	0	14,196	353	3	10,180
Zone	1	Total/Ave.				14,196	0	650	0	0	14,196	353	3	10,180
System	1	Total/Ave.				14,196	0	650	0	0	14,196	353	3	10,180
Buildin	g					14,196	0	, 650	0	0	14,196	353	3	10,180

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

System Totals

Percent	Cool	ing Loa	d	Heatir	g Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-17,475	10	222	0.0	0	0	0.0	0	0
5 - 10	0.0	0	0	-34,950	8	189	0.0	0	0	0.0	. 0	0
10 - 15	0.0	0	0	-52,425	11	242	0.0	. 0	0	0.0	0	0
15 - 20	0.0	0	0	-69,900	7	151	0.0	0	0	0.0	G	0
20 - 25	0.0	0	0	-87,375	8	194	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-104,850	5	113	0.0	0	0	0.0	0	0
30 - 35	0.0	0	0	-122,325	9	200	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-139,800	6	142	0.0	0	0	0.0	0	0
40 - 45	0.0	0	0	-157,275	9	210	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-174,750	8	183	0.0	0	0	0.0	0	0
50 - 55	0.0	0	0	-192,225	7	160	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-209,700	7	149	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-227,175	5	108	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-244,650	1	20	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-262,125	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-279,600	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-297,075	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-314,550	0	0	0.0	0	0	0.0	0	0
90 - 95	0.0	0	0	-332,025	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-349,500	0	0	0.0	0	0	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,477	0.0	0	8,760	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

- M U N I	I H L Y	ENERGY	CONSUMPTI	O N
-----------	---------	--------	-----------	-----

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	2,285	10	1,281	4
Feb	2,013	10	885	3
March	2,093	10	50	2
April	1,757	10	0	0
May	1,909	10	0	0
June	1,898	10	0	0
July	1,768	10	0	0
Aug	1,980	10	0	0
Sept	1,757	10	0	0
Oct	1,909	10	0	0
Nov	2,042	10	164	2
Dec	2,215	10	901	3
Total	23,627	10	3,281	4

Building Energy Consumption = Source Energy Consumption =

28,795 (Btu/Sq Ft/Year) 29,510 (Btu/Sq Ft/Year) Floor Area =

14,196 (Sq Ft)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

	•		
UTILITY	PEAK CHEC	KSUMS	
Utility ELECTRIC DEMAND			
Peak Value 10.3 (kW) Yearly Time of Peak 9 (hr) 1 (mo)			
Hour 9 Month 1			
Sub Total	0.0	0.00	
Heating Equipment	•		
1 EQ2201 GAS FIRED UNIT HEATER	0.6	5.85	
Sub Total	0.6	5.85	
Sub Total	0.0	0.00	
Sub Total	0.0	0.00	
Miscellaneous			
Lights	9.7	94.15	
Base Utilities	0.0	0.00	
Misc Equipment	0.0	0.00	
Sub Total	9.7	94.15	
Grand Total	10.3	100.00	

ESOS STUDY AT WSMR - BUILDING 1833
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO

Weather File Code:	ELPASO	.W
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)

3.9171 (Lb-min./hr/cuft)

Heating Only with Unit Heators One Room - High Bay Only.

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Enthalpy Factor:

Time/Date Program was Run: 14:21:33 1/19/92 Dataset Name: 1833 .TM

TAS = 650

PAGE

System 1 Block UH - UNIT HEATERS

Peaked at	Time ==>		Mo/Hr: (0/ 0			*	Mo	Hr: 0	/ 0 *		Mo/Hr: 1	3/1	
Outside A		OAI	DB/WB/HR:	0/ 0/ 0.0)		*	0.7	DB:	0 *		OADE:	24	
							*			*				_
		Space		Ret. Air		Percnt		•	ace	Percnt *	Space Po			Percnt
		s.+Lat.	Sensible	Latent	Total			Sensi		Of Tot *	Space Se			Of Tot
Envelope 1	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)		(B1	uh)	(%) *	(Bt	,	tuh)	(%)
Skylite	Solr	0	0		0				0	0.00 *		0	0	0.00
Skylite		0	0		0				0	0.00 *		0	0	0.00
Roof Co	nd	0	0		0				0	0.00 *	-23,		,122	8.01
Glass So	olar	0	0		0				0	0.00 *		0	0	0.00
Glass Co	ond	0	0		0				0	0.00 *	-21,		,797	7.55
Wall Con	nd	0	0		0	0.00	*		0	0.00 *	-128,		-	44.64
Partitio	on	0			0	0.00	*		0	0.00 *		0	0	0.00
Exposed	Floor	0			٥	0.00	*		0	0.00 *	-16,	421 -16	,421	5.69
Infiltra	ation	0			0	0.00	*		0	0.00 *	-98,	396 -98	,396	34.10
Sub Tota	al==>	0	0		0	0.00	*		0	0.00 *	-288,	555 -288	,555	100.00
Internal I	Loads						*			*				
Lights		0	0		O				0	0.00 *		0	0	0.00
People		0			O	0.00	*		О	0.00 *		0	0	0.00
Misc		0	0	0	0	0.00	*		0	0.00 *		0	0	0.00
Sub Tota	al==>	0	0	0	O	0.00	*		٥	0.00 *		0	0	0.00
Ceiling Lo	bad	0	0		0	0.00	*		0	0.00 *		0	0	0.00
Outside A	ir	0	0	0	0	0.00	*		0	0.00 *		0	0	0.00
Sup. Fan I	Heat				O	0.00	*			0.00 *			0	0.
Ret. Fan 1	Heat		0		ď	0.00	* (0.00 *			0	0.00
Duct Heat	Pkup		0		O	0.00	*			0.00 *			0	0.00
OV/UNDR S	izing	0			O	0.00	*		0	0.00 *		0	0	0.00
Exhaust He	eat		0	0	C	0.00	*			0.00 *			0	0.00
Terminal 1	Bypass		0	0	C	0.00	* (0.00 *			0	0.00
Grand Tota	al==>	0	0	0	c	0.00	* ; *		0	0.00 *	-288,	555 -288	,555	100.00
			CDO	LING COIL SI Coil Airfl		ng DB/WI			ing DB		Gross To	AREAS-	 ss (sf) (%)
	Total Ca		-	(cfm)		-	ains	Deg F	_	Grains	Floor	12,532	99 (9I	, (*)
	(Tons)	(Mbh)	(Mbh) 0.0	(CIM)	0.0	0.0	0.0	0.0	0.0	0.0	Part	0		
ain Clg			0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	534		
ux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	12,532		0 0
pt Vent otals	0.0	0.0	0.0	U	0.0	0.0	0.0	0.0	0.0	0.0	Wall	8,544	4	22 5
			nom to w		A)	THET OUR	(a f m)		10	NGINEERING	CHECKS	TEMPER	AMITORS	(E)
			ECTION irfl Ent	Lvg	Туре	Cooling		Heating		# OA	0.0	Type	Clg	Htg
	(Mbh)	(cf		-	Vent		9	neacing 0	_	Cfm/Sqft	0.00	SADB	-	104.2
oin Pt-	(MDR) -466.6	•	m, begr 695 40.8	-	Infil		0 .	2,506	-	Cfm/Ton	0.00	Plenum	0.0	
ain Htg	0.0	•	0 0.0		Supply		0	7,695	-	Sqft/Ton		Return	0.0	
ux Htg reheat	0.0		0 0.0		Mincfm		0	0,033	_	Btub/Sqft		Ret/OA	0.0	
reneat eheat	0.0		0 0.0		Return		0	7,695		People	0.00	Runarnd	0.0	
umidif	0.0		0 0.0		Exhaust		0	0,033		% OA	0.0	Fn MtrTD		
	0.0		0.0	3.5	~~***		-	U	11.09		0.0		5.0	0.1
pt Vent	0.0		0 0.0	0.0	Rm Exh		0	0	Яtа	Cfm/SqFt	0.61	Fn BldTD	0.0	0.1

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1 BASELINE BUILDING 1833

(At time of Coil Peak)

Ventilation Op. Vent Reheat Humidif													
Room		Airflow	Sensible	Airflow	Sensible	Airflow	Sensible	Airflow	Latent	Total			
Number	Description	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Btuh)			
1	1ST FLOOR	0	0	0	0	0	0	0	0	0			
Zone	1 Total/Ave.	0	0	0	0	0	0	0	0	0			
Zone	1 Block	0	0	0	0	0	0	0	0	0			
System	1 Total/Ave.	0	0	0	0	0	0	0	0	0			
System	1 Block	0	0	0	0	0	0	0	0	0			

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1
BASELINE BUILDING 1833

(At time of Coil Peak)

							- Heating	3					
			Supply	Return	System		System	Room			Run		System
			Fan	Fan	Exhaust		Exhaust	Exhaust	Ducted	Plenum	Around	Corridr	Return
Room			Heat	Heat	Heat Loss	Total	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow
Number	D	escription	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)
1	1ST F	LOOR	0	0	0	0	0	0	0	0	0	0	7,695
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	7,695
Zone	1	Block	0	0	0	0	0	0	0	0	0	0	7,695
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	7,695
System	1	Block	0	0	0	0	0	0	0	0	0	0	7,695

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 1833

BUILDING U-VALUES-----

	Room U-Values (Btu/hr/sqft/F)												Room Capac.
Room					Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Desc	cription	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST I	FLOOR	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.387	0.000	91.5	19.21
Zone	1	Total/Ave.	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.387	0.000	91.5	19.21
System	1	Total/Ave.	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.387	0.000	91.5	19.21
Buildin	g		0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.387	0.000	91.5	19.21

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

V 600 PAGE

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 1833

------BUILDING AREAS ------

Room			er of	Floor Area/Dupl Room	Total Floor Area	Partition Area	Exposed Floor Area	Skylight Area	Skl /Rf	Net Roof Area	Window Area	Win /Wl	Net Wall
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(\$)	(sqft)	(sqft)	(%)	(sqft)
1	1ST FLOOR	1	1	12,532	12,532	0	534	o	0	12,532	422	5	8,122
Zone	1 Total/Ave	₽.		•	12,532	0	534	0	0	12,532	422	5	8,122
System	1 Total/Ave	э.			12,532	0	534	0	0	12,532	422	5	8,122
Buildin	ıg				12,532	0	534	0	0	12,532	422	5	8,122

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

System Totals

Percent	Cool	ing Loa	d	Heatir	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.0	0	0	-23,328	10	240	384.7	0	0	0.0	0	. 0
5 - 10	0.0	0	0	-46,656	23	565	769.5	0	0	0.0	0	0
10 - 15	0.0	0	0	-69,984	14	334	1,154.2	0	0	0.0	0	0
15 - 20	0.0	0	0	-93,312	20	503	1,539.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-116,640	15	380	1,923.7	0	0	0.0	0	0
25 - 30	0.0	0	0	-139,968	10	243	2,308.5	0	0	0.0	0	0
30 - 35	0.0	0	0	-163,296	8	197	2,693.3	0	0	0.0	0	0
35 - 40	0.0	0	0	-186,624	0	0	3,078.0	0	0	0.0	0	0
40 - 45	0.0	0	٥	-209,952	0	0	3,462.8	0	0	0.0	0	0
45 - 50	0.0	0	0	-233,280	0	0	3,847.5	0	0	0.0	0	0
50 - 55	0.0	0	0	-256,608	0	0	4,232.3	0	0	0.0	0	0
55 - 60	0.0	0	0	-279,936	0	0	4,617.0	0	0	0.0	0	0
60 ~ 65	0.0	0	0	-303,264	0	0	5,001.8	0	0	0.0	0	0
65 - 70	0.0	0	0	-326,592	0	0	5,386.5	. 0	0	0.0	0	0
70 - 75	0.0	0	o	-349,920	0	0	5,771.3	0	0	0.0	0	0
75 - 80	0.0	0	0	-373,248	0	0	6,156.0	0	0	0.0	o	0
80 - 85	0.0	0	0	-396,576	0	0	6,540.8	0	0	0.0	0	0
85 - 90	0.0	0	0	-419,904	0	0	6,925.5	0	0	0.0	0	0
90 - 95	0.0	0	0	-443,232	0	0	7,310.3	0	0	0.0	0	0
95 - 100	0.0	0	0	-466,560	0	0	7,695.0	100	8,760	0.0	0	0
Hours Off	0.0	0	8,760	0	0	6,298	0.0	0	0	0.0	0	8.760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

MONTHLY ENERGY CONSUMPTION MONTHLY ENERGY

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	3,271	15	1,048	3
Feb	2,958	16	785	3
March	3,246	16	104	2
April	2,805	15	0	0
May	3,049	15	0	0
June	3,030	15	0	0
July	2,824	15	0	0
Aug	3,161	15	0	0
Sept	2,805	15	0	0
Oct	3,049	15	0	0
Nov	3,042	16	164	2
Dec	3,159	16	750	3
Total	36,401	16	2,851	3

Building Energy Consumption = 32,664 (Btu/Sq Ft/Year)
Source Energy Consumption = 33,368 (Btu/Sq Ft/Year)

Floor Area = 12,532 (Sq Ft)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

 UTILITY	PEAK	C H E C K S U M S

Utility ELECTRIC DEMAND

Peak Value 15.9 (kW)

Yearly Time of Peak 9 (hr) 1 (mo)

Hour 9 Month 1

Sub rotal	0.0	0.00
Heating Equipment		

1	EQ2201	GAS	FIRED	UNIT	HEATER	0.4	2.84
Sub Total						0.4	2.84
Sub Total						0.0	0.00
Sub Total						0.0	0.00

Miscellaneous

Lights	15.4	97.16
Base Utilities	0.0	0.00
Misc Equipment	0.0	0.00
Sub Total	15.4	97.16
Grand Total	15.9	100.00

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TRACE
      600
          ANALYSIS
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ESOS STUDY AT WSMR - BUILDING 1833 WHITE SANDS MISSILE RANGE NM US ARMY

INFRARED HEATERS: ALT 1-BSLN, ALT2-ECO (CO 717)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg)

Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft) Air Specific Heat: 0.2444 (Btu/lbm/F) Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft) Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 7: 0:33 1/21/92 Dataset Name: 1833 .TM

75-2--1

System	1	Block	RAD	-	RADIATION	

Peaked a	at Time ==:	>	Mo/Hr:	0/0			*	Mo	/Hr:	0/0 '	•	Mo/Hr	: 13/ 1	
Outside			DB/WB/HR:	0/ 0/ 0.	0		*		ADB:	0 1	,		: 24	
							*			,	t	5,05		
		Space	Ret. Air	Ret. Air	Ne	t Perci	nt *	s	pace	Percnt 1	Space	Peak Co	il Peak	Percnt
	S	ens.÷Lat.	Sensible	Latent	Tota	i Of To	ot *	Sens	ible	Of Tot	Space	Sens To	ot Sens	Of Tot
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh) (%) *	(B	tuh)	(%)	(B	tuh)	(Btuh)	(%)
Skylit	te Solr	0	C	i	(0.0	00 *		0	0.00	•	0	0	0.00
Skylit	te Cond	0	0		(0 0.0	00 *		0	0.00	•	0	0	0.00
Roof C	Cond	0	0		(0 0.0	00 *		0	0.00	-20	,866	-20,866	8.01
Glass	Solar	0	0		(0.0	00 *		0	0.00	•	0	0	0.00
Glass	Cond	0	0		1	0.0	* 00		0	0.00	-19	,679 -	-19,679	7.56
Wall (Cond	0	0		1	0.0	00 *		0	0.00	-116	,253 -	116,253	44.64
Partit	ion	0				0.0	* 00		0	0.00	•	0	. 0	0.00
Expose	ed Floor	0			(0.0	• 00		0	0.00	-14	,819	-14,819	5.69
Infilt	ration	0			(0.0	00 *		0	0.00			-88,796	34.10
Sub To	tal==>	0	0		(0.0	* 00		0	0.00		-	260,412	100.00
Internal	Loads						*				•	•	•	
Lights	3	0	0		(0.0	00 *		0	0.00	•	0	0	0.00
People	:	0			(0.0	00 *		0	0.00	•	0	0	0.00
Misc		0	0	0		0.0	00 *		0	0.00	,	0	0	0.00
Sub To	tal==>	0	0	0	(0.0	00 *		0	0.00	•	0	0	0.00
Ceiling	Load	0	0		(0.0	00 *		0	0.00	•	0	0	0.00
Outside	Air	0	0	0	(0.0	00 *		0	0.00	•	0	0	0 00
Sup. Fan) Heat				(0.0	00 *			0.00	•		Q	
Ret. Far	Heat		0		(0.0	* 00			0.00	•		0	0.00
Duct Hea	it Pkup		0		(0.0	00 *			0.00	,		0	0.00
OV/UNDR	Sizing	0			(0.0	00 *		0	0.00	•	0	0	0.00
Exhaust			0	0	(0.0	00 *			0.00	•		0	0.00
Terminal	Bypass		0	0	(0.0	00 *			0.00 *	•		0	0.00
							*			1	•			
Grand To	tal==>	0	0	0	(0.0	00 *		0	0.00 *	-260	,412 -2	260,412	100.00
			coo	LING COIL S	FI FCT ION			******	•••••			AREA		
	Total (Capacity		Coil Airfl		ing DB/W	JB/HR	Lea	ving D	B/WB/HR	Gross To		ilass (s	f) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)		-	rains			Grains	Floor	12,532	11033 (3	17 (74)
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0		Part	0		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0		Exflr	534		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0		Roof	12,532		0 0
Totals	0.0	0.0									Wall	8,544		422 5
	UEATINA													
			ECTION		A1		-			ENGINEERING				S (F)
	Capacity			Lvg	Туре	Coolir	-	Heating		g % OA	0.0	Type	_	_
lain Ktg	(Mbh) -247.5	(cfi	_	Deg F	Vent		0	0		g Cfm/Sqft	0.00	SADB	0.0	
Aux Htg	0.0		0 0.0	0.0	Infil		0	2,506		g Cfm/Ton	0.00	Plenum		
Preheat	0.0		0.0	0.0	Supply		0	0		g Sqft/Ton	0.00	Return		
Reheat	0.0		0 0.0	0.0	Mincfm		0	0		g Btuh/Sqft		Ret/OA		
Humidif	0.0			0.0	Return		0	0		. People	0	Runarn		
Opt Vent	0.0		0 0.0	0.0	Exhaust		0	0		g % OA	0.0	Fn Mtr		
Total	-247.5		0.0	0.0	Rm Exh		0.	0		g Cfm/SqFt	0.00	Fn Bld		
	471.3	•			Auxil		0	0	нt	g Btuh/SqFt	-19.75	Fn Fri	ct 0.0	0,2

HEATING LOADS AT COIL PEAK - ALTERNATIVE 2 INFRARED HEATERS - 1833

------ AIRFLOW HEATING LOADS ------(At time of Coil Peak)

			Vent	ilation	Op.	Vent	Rel	neat	Hum	idif	
Room			Airflow	Sensible	Airflow	Sensible	Airflow	Sensibl e	Airflow	Latent	Total
Number		Description	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Cfm)	(Btuh)	(Btuh)
1	1ST F	LOOR	0	0	0	0	0	0	0	0	0
Zone	1	Total/Ave.	0	0	0	0	0	- 0	0	0	0
Zone	1	Block	0	0	0	0	0	0	0	0	0
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0
System	1	Block	0	0	0	0	0	0	0	0	0

HEATING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 2 INFRARED HEATERS - 1833

						*********	- Heating	g	******				*****
			Supply	Return	System		System	Room			Run		System
			Fan	Fan	Exhaust		Exhaust	Exhaust	Ducted	Plenum	Around	Corridr	Return
Room			Heat	Heat	Heat Loss	Total	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow	Airflow
Number	0	escription	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)	(Cfm)
1	1ST F	LOOR	0	0	0	0	0	0	0	0	0	0	0
Zone	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
Zone	1	Block	0	0	0	0	0	0	0	0	0	0	0
System	1	Total/Ave.	0	0	0	0	0	0	0	0	0	0	0
System	1	Block	0	0	0	0	0	0	0	0	0	0	0

BUILDING U-VALUES - ALTERNATIVE 2
INFRARED HEATERS - 1833

	Room U-Values (Btu/hr/sqft/F)										Room Mass	Room Capac.	
Room					Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Desc	ription	Part.	Exflr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	1ST F	LOOR	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.387	0.000	91.5	19.21
Zone	1	Total/Ave.	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.387	0.000	91.5	19.21
System	1	Total/Ave.	0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.387	0.000	91.5	19.21
Buildin	g		0.000	0.750	0.000	0.000	0.045	1.140	1.259	0.387	0.000	91.5	19.21

BUILDING AREAS - ALTERNATIVE 2
INFRARED HEATERS - 1833

Room				er of icate	Floor Area/Dupl Room	Total Floor Area	Partition Area	Exposed Floor Area	Skylight Area		Net Roof Area	Window Area		Net Wall Area
Number	Descr	iption	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	1ST F	LOOR	1	1	12,532	12,532	0	534	0	0	12,532	422	5	8,122
Zone	1	Total/Ave	• .			12,532	0	534	0	0	12,532	422	5	8,122
System	1	Total/Ave				12,532	0	534	0	0	12,532	422	5	8,122
Buildin	g					12,532	0	534	0	0	12,532	422	5	8,122

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

System Totals

Percent	Coo	ling Loa	id	Heatin	g Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
		_	_									
0 - 5		0	0	-12,375	9	172	0.0	0	0	0.0	0	0
5 - 10		0	0	-24,750	14	268	0.0	0	0	0.0	0	0
10 - 19	0.0	0	0	-37,125	9	181	0.0	0	0	0.0	0	0
15 - 20	0.0	0	0	-49,500	8	153	0.0	0	0	0.0	0	0
20 - 25	0.0	0	0	-61,875	10	189	0.0	0	0	0.0	0	0
25 - 30	0.0	0	0	-74,250	11	219	0.0	0	0	0.0	0	0
30 - 39	0.0	0	0	-86,625	7	135	0.0	0	0	0.0	0	0
35 - 40	0.0	0	0	-99,000	12	241	0.0	0	0	0.0	. 0	0
40 - 45	0.0	0	0	-111,375	8	153	0.0	0	0	0.0	0	0
45 - 50	0.0	0	0	-123,750	6	128	0.0	0	0	0.0	0	٥
50 - 55	0.0	0	0	-136,125	5	89	0.0	0	0	0.0	0	0
55 - 60	0.0	0	0	-148,500	2	49	0.0	0	0	0.0	0	0
60 - 65	0.0	0	0	-160,875	0	0	0.0	0	0	0.0	0	0
65 - 70	0.0	0	0	-173,250	0	0	0.0	0	0	0.0	0	0
70 - 75	0.0	0	0	-185,625	0	0	0.0	0	0	0.0	0	0
75 - 80	0.0	0	0	-198,000	0	0	0.0	0	0	0.0	0	0
80 - 85	0.0	0	0	-210,375	0	0	0.0	0	0	0.0	0	0
85 - 90	0.0	0	0	-222,750	0	0	0.0	0	0	0.0	0	0
90 - 99	0.0	0	0	-235,125	0	0	0.0	0	0	0.0	0	0
95 - 100	0.0	0	0	-247,500	0	0	0.0	0	0	0.0	0	0
Hours Of	f 0.0	0	8,760	0	0	6,783	0.0	0	8,760	0.0	0	8.760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

----- MONTHLY ENERGY CONSUMPTION -----

ELEC	DEMAND	GAS	GAS DMND
On Peak	On Peak	On Peak	On Peak
(kWh)	(kW)	(Therm)	(Thrm/hr)
3,271	16	703	2
2,951	16	475	2
3,176	16	12	1
2,805	15	0	0
3,049	15	0	0
3,030	15	0	0
2,824	15	0	0
3,161	15	0	0
2,805	15	0	0
3,049	15	0	0
2,863	16	47	1
3,078	16	453	2
36,064	16	1,691	2
	On Peak (kWh) 3,271 2,951 3,176 2,805 3,049 3,030 2,824 3,161 2,805 3,049 2,863 3,078	On Peak (kWh) 3,271 16 2,951 16 3,176 16 2,805 15 3,049 15 3,030 15 2,824 15 3,161 15 2,805 15 3,049 15 2,824 15 3,161 15 2,805 15 3,049 15 2,805 15 3,049 15 2,863 16 3,078 16	On Peak (kWh) (Cherm) 3,271 16 703 2,951 16 475 3,176 16 12 2,805 15 0 3,049 15 0 3,030 15 0 2,824 15 0 2,824 15 0 3,161 15 0 2,805 15 0 3,049 15 0 2,863 16 47 3,078 16 453

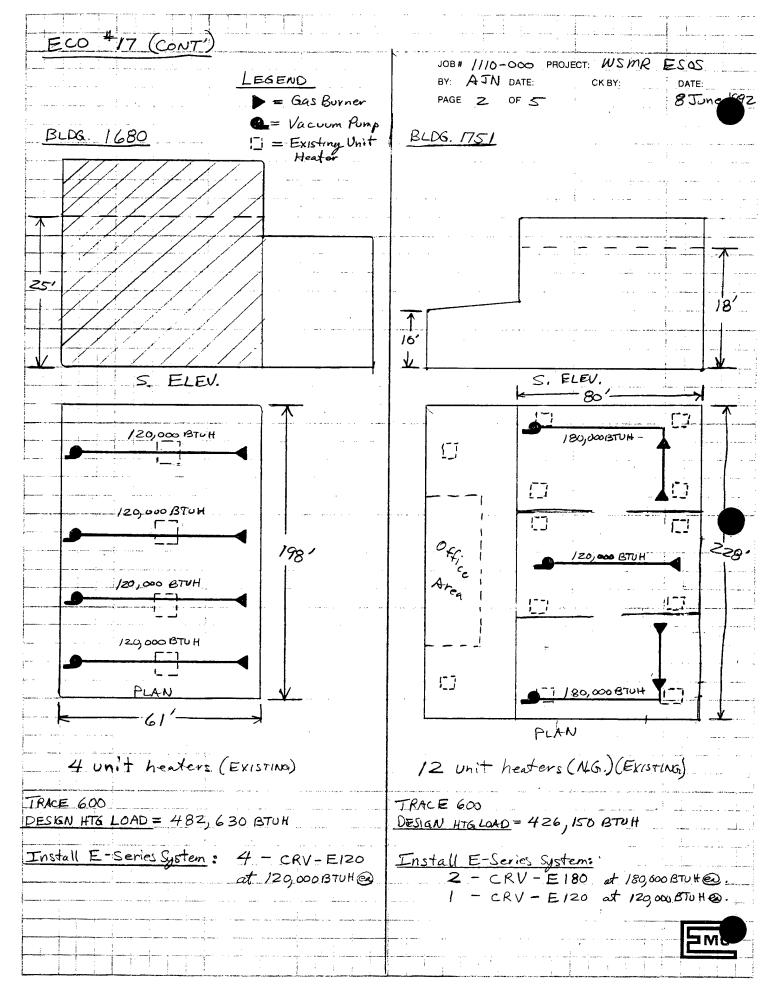
Building Energy Consumption = Source Energy Consumption = 23,312 (Btu/Sq Ft/Year) 23,729 (Btu/Sq Ft/Year)

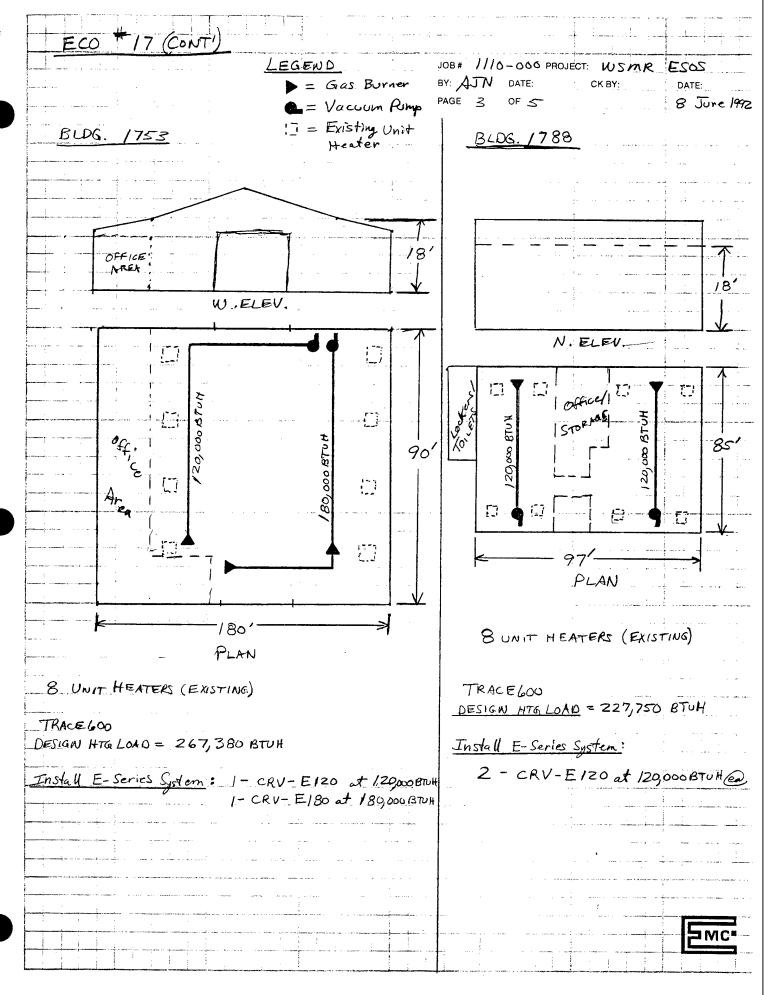
Floor Area = 12,532 (Sq Ft)

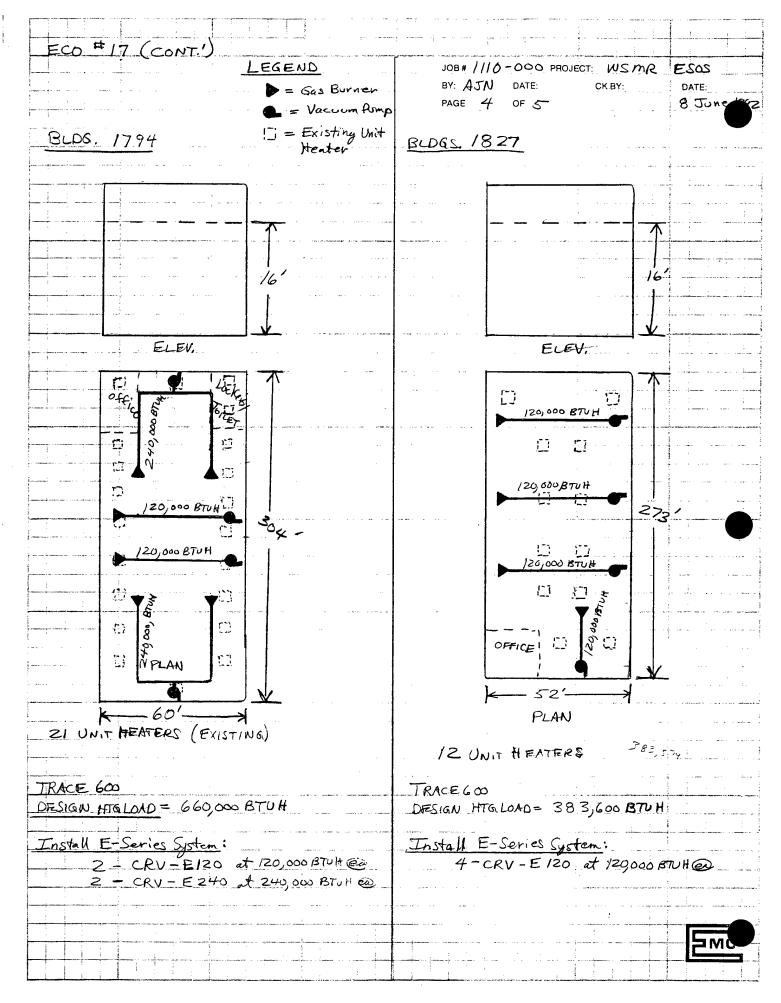
UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

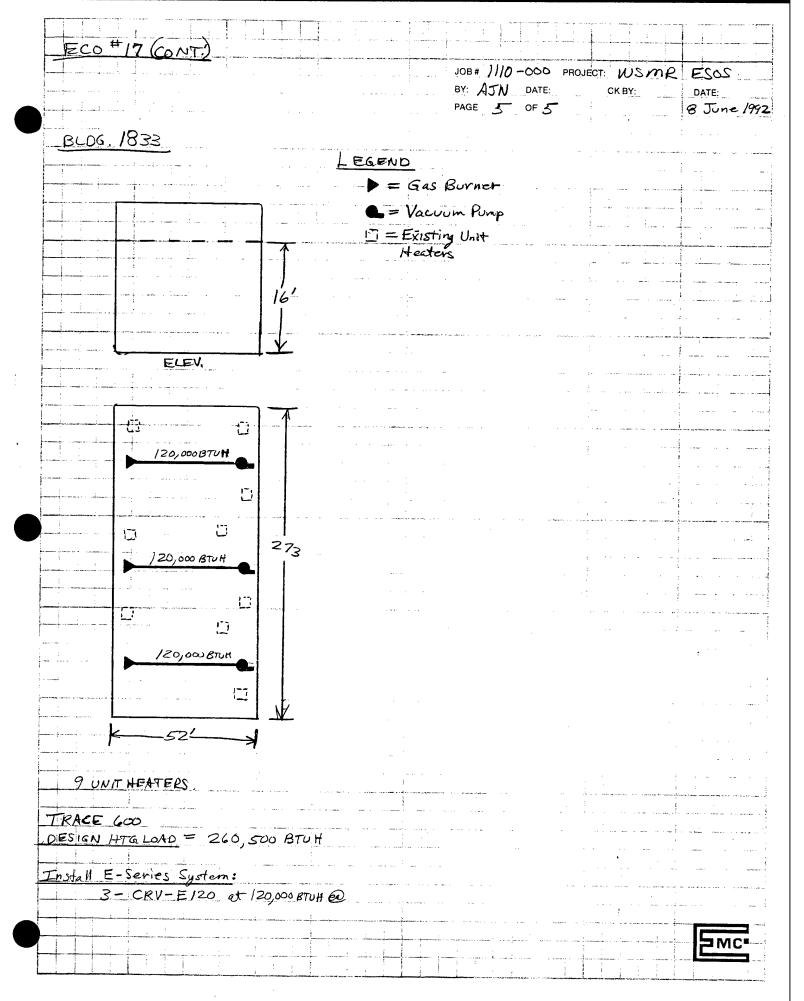
U T I L I T	Y PEAK CHEC	KSUM	s
Utility ELECTRIC DEMAND			
Peak Value 15.9 (kW) Yearly Time of Peak 9 (hr) 1 (mo)			
Hour 9 Month 1			
Sub Total	0.0	0.00	
Heating Equipment			
1 EQ2201 GAS FIRED UNIT HEATER	0.4	2.84	
Sub Total	0.4	2.84	
Sub Total	0.0	0.00	
Sub Total	0.0	0.00	
Miscellaneous			
Lights	15.4	97.16	
Base Utilities	0.0	0.00	
Misc Equipment	0.0	0.00	
Sub Total	15.4	97.16	
Grand Total	15.9	100.00	

ECO#17: Replace Unit Heaters W/ Infrared Heaters (N.G.) -000 PROJECT: WSMR ESOS BY: AJN 8 June 1992 PAGE / OF 5 BLDG. 1550 & 1554 BLDG. 1644 25 S. ELEV. West 180,000 BTUH 53 EXSTING UNLT HEATER PLAN 103' 180' 3 EXSTNG UNITHEATERS (HW FC) TRACE 600 DESIGN ATE LOAD = 144,000 BTOH Install E-Series System: CRV-E180 at 180,000 BTUH TRACE 600 DESIGN HTG LOAD = 303, 350 BTUH Install E-Series System: CRV-E360 at 360,000 BTUH LEGEND. = Gas Burner = Vacuum Pump. 0 = EXISTING FAN COIL









E SERIES



Roberts-Gordon, Inc.



ESERIES Pre-Engineered Systems Are Practical and Energy-Saving

Reduce Fuel Costs and Improve Comfort

E Series systems combine the latest in gas combustion technology with the principles of infrared energy to provide an efficient and economical way to heat. Users report that Roberts-Gordon gas-fired infrared heating equipment dramatically improves worker comfort and slashes fuel bills up to 50% and more!

Competitive Cost...Easy to Install and Maintain

E Series is pre-engineered to reduce design costs and simplify installation. E Series systems are built to provide years of economical operation and trouble-free service.

Design Flexibility

E Series systems are available in five practical models with system inputs ranging from 120,000 through 360,000 BTU/Hr. These basic models offer many different variations in design configurations to fit a wide variety of building layouts and areas to be heated.

Complete Product Line

E Series is part of the broadest product line of low-intensity infrared heating equipment in North America. Roberts-Gordon gas-fired radiant heating equipment also includes custom-engineered Co-Ray-Vac condensing vacuum systems and economy-priced, vacuum-vented EconoVac systems plus Vantage II and Gordon-Ray unitary heaters.

Reliability and Expertise

Roberts-Gordon pioneered lowintensity infrared heating systems in the late 1950's and continues to maintain leadership in the industry. Backed by a three-year limited warranty, each E Series system is built to uphold the well-established Roberts-Gordon standards of engineering excellence, efficiency and reliability.

Applications Include:

- Aircraft Hangars
- Automotive Facilities
- Warehouses
- Manufacturing Facilities
- Fire Stations
- Agricultural Buildings
- Recreational Facilities
- Machine Shops
- Vehicle Maintenance Buildings

System Features:

- Pre-engineered heat exchanger tube lengths.
- System capacities of 120,000; 180,000; 240,000; 300,000 and 360,000 BTU/Hr.
- Two burners can fire in series in one branch to provide more uniform comfort.
- One or two branches can be connected to one treated steel,
 1/3-hp vacuum pump.

- Vacuum-assisted system. Negative or varying ambient pressure does not affect operation. No leakage of flue gases or products of combustion into the building.
- Safety vacuum switch prevents energization of burners in the event of motor failure.
- Single or dual zone temperature control for multi-branch systems.
- Extensive use of corrosion resistant materials.

- Weight-saving construction to ease installation.
- Clean, quiet, draft-free heat.
- Three-year limited warranty on all components.
- A.G.A. design certified.

STERRICE BASIC STREETS

The five it series basic systems can be modified to fit a wife variety of flow plans and heating needs shown in each box below are a solicination of each it series distinguishors system plus thus estions of two design configurations was more ambiguations at a possible.

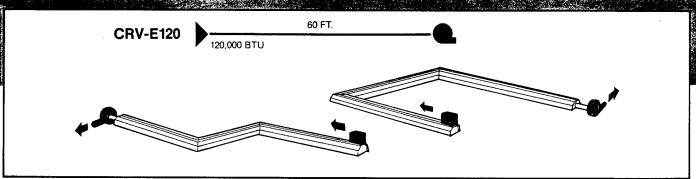
Il Saite Besic System: Schemetic

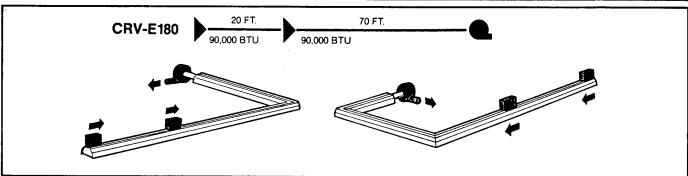
 ~ 4 ($\frac{1}{2}$ ($\frac{1}{2}$) $\frac{1}{2}$ ($\frac{1}{2}$) $\frac{1}{2}$ ($\frac{1}{2}$) $\frac{1}{2}$

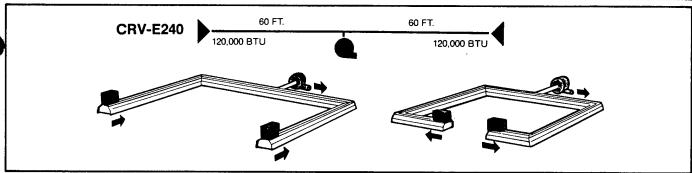


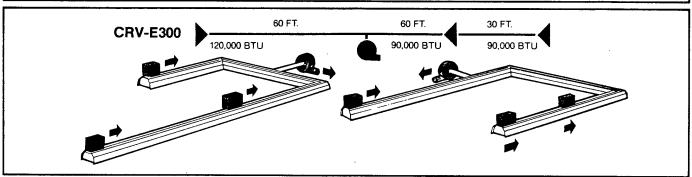
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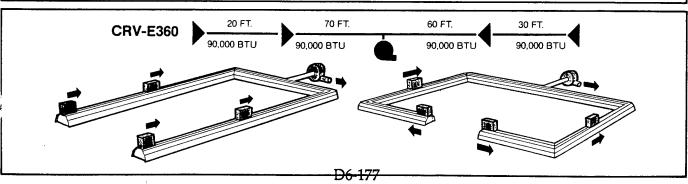
Note Programs are not stown to sedle



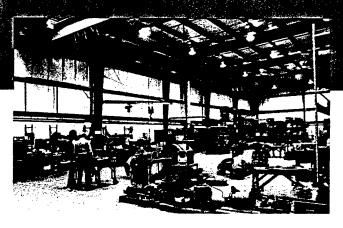




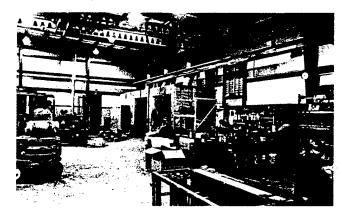




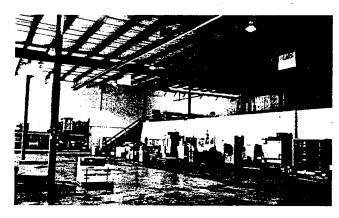
Typleal E SERVES Treallactore



Workers are more comfortable at lower thermostat settings because E Series systems heat the floor, people and objects directly. This enables users to cut fuel bills significantly.



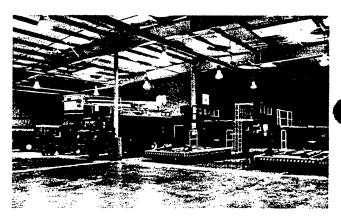
Optional side reflector extensions on this E Series system reflect radiant energy toward the middle of the shop where it is needed.



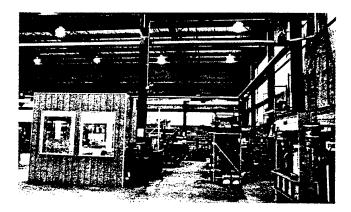
E Series systems are available in several pre-engineered packages that can be customized to meet individual floor plans and areas to be heated.



E Series systems provide clean, quiet, draft-free heat. They are ideal for automotive and manufacturing facilities because, unlike forced-air heaters, E Series systems do not spread dirt, grit or dust.



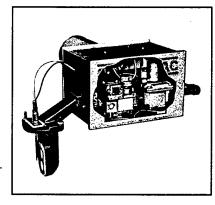
E Series radiant heat melts snow and ice off vehicles to shorten return-to-service time. In addition, floors are kept warm and act as heat reservoirs to provide rapid heat recovery when bay doors are used.

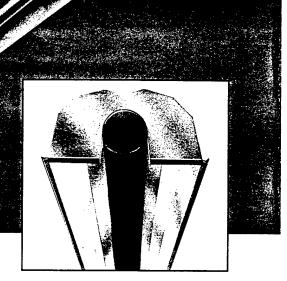


The capability of isolated combustion allows E Series systems to operate in hostile environments, such as this manufacturing facility in which halogenated hydrocarbons are present.

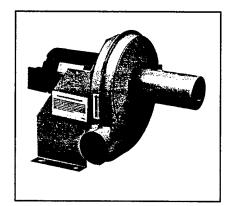
Burners:

- 90,000 and 120,000 BTU/Hr. inputs available.
- Natural gas and L.P. models available.
- Three-try direct spark ignition (D.S.I.).
- Constant regulation of air-to-gas ratio to achieve best mixture.
- Pre-purge capability standard.
- · Filtered combustion air.
- Cast-iron head; nickel plating optional.
- Mica flame observation window.
- Stainless steel flex gas line and high pressure gas cock included.





"Comfaris energy **efficiency:** and the cost conventioned of a fixe-packaged; system make ESERIES cadranti francis a frapular choice."



Vacuum Pump:

- 1/3-hp TENV
- Capacitor start
- Single phase
- Ball bearing
- Thermally-protected
- Life-lubricated bearings

Tube and Reflector:

- 4" diameter 16-gauge tubing, hot rolled and aluminized steel (all aluminized steel option).
- Quick assembly stainless steel couplings.
- Unique deep-dish aluminum reflectors maximize radiant effect to the floor.
- End caps included.
- · Nickel plated hangers.
- Chrome plated hardware.
- Side reflector option.
- Decorative grille option.

E SERIES

CRV-E SERIES SPECIFICATIONS

Chross cars	्राठोहरूठेचे प्रशिक्तः निप्रहाराहरू	્રે.િકો કુંકુંકુંકુંકુંકુંકુંકુંકુંકુંકુંકુંકુંક	HATING.		IGNITION SYSTIAN	IMN: G.J.S INLET PRES
	4" O.D.	1/2" NPT	115 VAC, 60 Hz. Burner: .30 amp each Vacuum Pump: 7.2 amp	4"	Direct spark (Three-try with pre-purge)	Natural 4.5" W.C. L.P. 10.5" W.C.

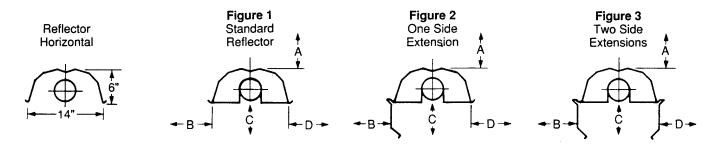
BASIC SYSTEMS

	एवल्डिन	્રા 14≣ામાલ€		
Model #	i≕ (€0,000 ETUILIA	ા⊒ક (૧૯૦,૦૦૦) કોર્માણીકોને	idel Eivlige	Total engli of rube
ास क्रिक्ट		1	120,000	60'
(Havesie)	2	-	180,000	. 90'
(#5 1/4 =2 20 - 5.		2	240,000	120'
(अहरेर विद्युष्टि)	2	1	300,000	150'
(H;V4\(\frac{1}{2}\)(1)	4	_	360,000	180'

CLEARANCES TO COMBUSTIBLES*

		FIGU	FE1			FIGU	RE2	View		FIGU	RE3	
IELERNIER:	A	Æ	•	Jū.	1:7	√į.	(0	D	Ø.	B	C	O:
(19)	4"	20"	40"	20"	4"	12"	46"	24"	4"	12"	46"	12"
Ge.	4"	24"	48"	24"	4"	12"	54"	34"	4"	12"	54"	12"

^{*} See installation manual for complete information.





Roberts-Gordon, Inc.

Subsidiary of A.J. Industries, Inc. P.O. Box 44 • Buffalo, NY 14240-0044 Phone: (716)852-4400 • Fax: (716)852-0854

CALL TOLL FREE: 1-800-828-7450 IN NEW YORK: 1-800-221-0955



LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION: Whit	te Sands Missile Ra	nge	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	ECO #19 & #20 -	BLDG. 100 - MODIF	Y HEATING CONTRO	LS	FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME: TO	TAL				
		ANALYSIS DATE:	06/15/92		ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER
1	IN۱	VESTMENT						
	A.	CONSTRUCTION	COST	=			\$12,071	
	В.	SIOH COST		(5.5% of 1A) =			\$664	
	C.	DESIGN COST		(6.0% of 1A) =			\$724	
	D.	ENERGY CREDIT		(1A+1B+1C) =			\$13,460	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	INT	(1D - 1E) =			>	\$13,460
2	ΕN	ERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$18.37	14	\$256	10.79	\$2,762	
	В.	DIST		0	\$0	11.57	\$0	
	C.	NAT GAS	\$2.21	826	\$1,826	12.38	\$22,610	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	11.35	\$0	
	F.	TOTAL		839	2,082.3		>	\$25,372
3	NO	N-ENERGY SAVIN	GS (+) / COST (-)					
	A.	ANNUAL RECURF	RING (+/-)		=		\$0	
		1 DISCOUNT FAC			(From Table A-2) =	14.68		
			SAVINGS (+) / COST	· (–)	$(3A \times 3A1) =$		\$0	
	В.	NON-RECURRING	3 (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		C.		\$0		0.00	\$0	
	_	d TOTAL		\$0			\$0	
				SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$0
	D.	PROJECT NON-E						
			NON-ENERGY CA	LCULATION		(2F5 x 0.33) =	\$8,373	
		a IF 3D1 => 3C T						
			HEN CALCULATE S	SIH		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T		O NOT OUNLIEV		•		
		a if suid < 1 if	IEN PROJECT DOE	S NOT QUALIFY				
A	EID	SET VEAD DOLLAR	CAMMOD (1) (OCC	TC()		. 64 . /654 1		
		RST YEAR DOLLAR TAL NET DISCOUN		10(-)	(2F3	+ 3A + (3B1d/25)) =		\$2,082
				NT DATIO (O'C'		(2F5 + 3C) =		\$25,372
0		SCOUNTED SAVING				(5/1F) =		1.89
7		F SIR < 1 THEN PRO MPLE PAYBACK (SP	*	QUALIFY)		,,=,n		_
′	3110	TE PATRAUN (SP	o)			(1F/4) =		6.46

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION: WI	nita Sande Missila	. Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				0 – BLDG. 124 – MODIF		•	FISCAL YEAR:	1992
		DISCRETE PORT		TOTAL				
		ANALYSIS DATE	: 06/15/92		ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER
1	IN۱	VESTMENT						
		CONSTRUCTION	COST	=			\$5,191	
		SIOH COST		(5.5% of 1A) =			\$286	
		DESIGN COST ENERGY CREDIT	r	(8.0% of 1A) = (1A + 1B + 1C) =			\$311 \$5.700	
		SALVAGE VALUE		(IA+IB+IC)=			\$5,788 \$0	
		TOTAL INVESTM		(1D – 1E) =				\$5,788
				(.5 .2, -				40,700
2	EN	ERGY SAVINGS (+) / COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$18.37	8	\$142	10.79	\$1,536	
	В.	DIST		0	\$0	11.57	\$0	
		NAT GAS	\$2.21	740	\$1,636	12.38	\$20,257	
		PAPER		0	\$0		\$0	
		COAL TOTAL		747	\$0 1 770 8	11.35	\$0	\$04 700
	г.	TOTAL		747	1,778.6		>	\$21,793
3	NO	N-ENERGY SAVII	NGS (+) / COST (-	-)				
		ANNUAL RECUR		•	=		\$0	
		1 DISCOUNT FA	CTOR		(From Table A-2) =	14.68	•	
		2 DISCOUNTED	SAVINGS (+) / CO	OST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRIN	IG (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a .		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c. d TOTAL		\$0 \$0		0.00	\$0	
	C.		ERGY DISCOUNT	FED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =	\$0	\$0
		PROJECT NON-E		. 25 0 (1) (1) (1)	• ()	(0/2 + 0504) =		40
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$7,192	
		a IF 3D1 => 3C	THEN GO TO 4			, ,		
		b IF 3D1 < 3C T	HEN CALCULAT	E SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1	THEN GO TO 4					
		d IF 3D1b < 1 T	HEN PROJECT D	OES NOT QUALIFY				
A	FID	ST YEAR DOLLAR	SAVINGS (1) (C	:OSTS (_)	/050	± 0.8 ± /0.044/05%		A4
		TAL NET DISCOU			(2F3	+ 3A + (3B1d/25)) = (2F5 + 3C) =		\$1,779 \$21,702
				MENT RATIO (SIR)		(5/1F) =		\$21,793 3.77
		SIR < 1 THEN PR				(3) =		5.77
7		IPLE PAYBACK (S		-		(1F/4) =		3.25

Ĺ											
		CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKD	N N							
8	CONTRACTOR	EMC ENGINEERS INC.		·	ADDRESS 2750 SO	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	ORTH BLVI	J., #C-200,	DENVER, CO	D 80227	
NO OS	ITRACT FC	CONTRACT FOR (Work to be performed) RADIANT HEATING SYSTEMS – BLDGS 100 & 124	0 & 124					PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PUP	CHASE RE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
<u></u>					MATERIAL COST	L COST		LABOR COSTS			
	Line	tem	C ^{nit}	Quantity			Manhours	Average		Other Direct	Line
	No.	(1)	Measure (2)	ති	Unit	Total (5)	Mandays (6)	Rate	Total (8)	Costs (9)	Total (10)
	-	BUILDING NO. 100									
		THERMOSTATIC CONTROL VALVES WITH WALL THERMOSTATS	EA	119	73.81	8783.39	119.00	27.63	3287.97		\$12,071.36
		TOTAL FOR BLDG. 100									\$12,071.36
	2	BUILDING NO. 124									
 D7-3		3" 3-WAY MIXING VALVE	EA	-	2735.30	2735.30	4.00	35.81	143.24		\$2,878.54
		HOT WATER RESET CONTROLLER	EA	2	375.00	750.00	4.00	35.81	143.24		\$893.24
		THERMOSTATS & WIRING	EA	9	62.50	375.00	12.00	35.81	429.72		\$804.72
l		LOW VOLTAGE TRANSFORMER	E	-	71.25	71.25	2.00	35.81	71.62		\$142.87
		SUBTOTAL FOR BLDG. 124			·						\$4,719.37
		CONTINGENCY (10%)									\$471.94
		TOTAL FOR BLDG. 124									\$5,191.31
		Material Source: M.P.D. Inc., Denver, CO; Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1	Profit; Labor Sour	ce: U.S. Dept. of	Labor, General V	Vage Decision No. NM	1-18				

************* TRACE 600 ANALYSIS ******************

ESOS STUDY AT WSMR - BUILDING 100 WHITE SANDS MISSILE RANGE NM US ARMY EMC ENGINEERS, INC. MODIFY HTG CONTROLS.

Cooling Load Methodology:

Time/Date Program was Run:

Dataset Name:

EC0#10

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20 Air Density: 0.0653 (Lbm/cuft) Air Specific Heat: 0.2444 (Btu/lbm/F) Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) Latent Heat Factor: 4,214.8 (8tu-min./hr/cuft) Enthalpy Factor: 3.9171 (Lb-min./hr/cuft) Design Simulation Period: May To October System Simulation Period: January To December

TETD/Time Averaging

19:50: 7 1/23/92

100A .TM

D7-5

schöbbaddis

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System	1	Block	RAD	- RADIATIO	N									
*****	*****	***** CO	OLING COIL	PEAK *****	*****	******	****	**** CLG SP	ACE P	EAK *****	***** HEA	TING COIL P		***
Peaked at				0/ 0			#	Mo/Hr	: 0/	0 *		Mo/Hr: 13,		
Outside A	\ir ==>	OAD	B/WB/HR:	0/ 0/ 0.0			*	OADB	: 0	*		OADB: 2	4	
							*			*				_
		Space	Ret. Air	Ret. Air	Net	Percnt	*	Spac		Percnt *	Space Pe			Percnt
	s	ens.+Lat.	Sensible	Latent	Total			Sensibl		Of Tot *	Space Se			Of Tot
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)			(Btuh		(%) *	(Btu			(%) 0.00
Skylite	e Solr	0	0		0				0	0.00 *		0	0	0.00
Skylite	e Cond	0	0		C				0	0.00 *	er 7	0		8.96
Roof Co	ond	0	0		0				0	0.00 *	-85,7	787 -85,1 0	0	0.00
Glass S	Solar	0	0		C				0	0.00	-102 6		-	20.15
Glass (Cond	0	0		0				0		-192,8	-		37.62
Wall Co	ond	0	0			0.00			0	0.00 *	-360,0	_		0.26
Partiti	ion	0			(0	0.00 *	-2,5	•	526	
Exposed	d Floor	0			(0.00	*		0	0.00 *		0 745	0	0.00
Infilt	ration	0			(0.00	*		0	0.00 *	-315,7			33.00
Sub Tot	tal==>	0	0		(0.00	*		0	0.00 *	-956,9	916 -956,	916	100.00
Internal	Loads						*			*		_	_	
Lights		0	0		(0.00	*		0	0.00 *		0	0	0.00
People		0			(0.00	*		0	0.00 *		0	0	0.00
Misc		0	0	0	(0.00	*		0	0.00 *		0	0	0.00
Sub To	tal==>	0	0	0	(0.00			0	0.00 *		0	0	0.00
Ceiling (Load	0	0		(0.00			0	0.00 *		0	0	0.00
Outside /	Air	0	0	0		0.0			0	0.00 *		0	0	0.00
Sup. Fan	Heat					0.0				0.00 *			0	0.00
Ret. Fan	Heat		0			0.0				0.00 *			0	0.00
Duct Hea	t Pkup		0			0.0			_	0.00 *		0	0	0.00
OV/UNDR	Sizing	0				0.0			0	0.00 *		0	0	ž
Exhaust	Heat		0			0.0				0.00 *			0	0.00
Terminal	Bypass		0	0	1	0 0.0	v *			0.00 *			ŭ	0.00
			_	_					^		-956,	916 -956,	016	100.00
Grand To	tal==>	0	0	0		0 0.0	0 *		0	0.00 *	-930,	310 -320 ¹	, , , ,	100.00
				LING COIL S						/i ID / UD	Gross To	AREAS-	 e (ef	(%)
		Capacity	Sens Cap.	Coil Airfl		ing DB/W eg F Gr				/WB/HR Grains	Floor	30,722	(, (,
	(Tons)	(Mbh)	(Mbh)	(cfm)		egrui 0.0		0.0	0.0	0.0	Part	22,258		
Main Clg	0.0		0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	0		
Aux Clg	0.0	0.0	0.0	0	0.0		0.0	0.0	0.0	0.0	Roof	15,572		0 0
Opt Vent	0.0		0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Wall	22,789	3,3	
Totals	0.0	0.0									watt	22,107	-,-	
		NG COIL SEL			A					NGINEERING		TEMPER		
	Capaci			Lvg	Type	Coolin	-	Heating	_	% OA	0.0	Type	Clg 0.0	Htg 70.1
	(Mbh				Vent		0	0		Cfm/Sqft	0.00	SADB	0.0	
Main Htg	-1,273		0 0.0		Infil		0	7,168	-	Cfm/Ton	0.00	Plenum	0.0	
Aux Htg		.0	0 0.0		Supply		0	0	-	Sqft/Ton	0.00	Return Pet/OA		
Preheat		.0	0 0.0		Mincfm		0	0	-	Btuh/Sqft		Ret/OA	0.0	
Reheat		.0	0 0.0		Return		0	0		People	0	Runarnd	0.0	
Humidif		.0	0 0.0		Exhaust		0	0	-	% OA	0.0	Fn MtrTD	0.0	
Opt Vent		.0	0 0.0	0.0	Rm Exh		0	0	_	Cfm/SqFt	0.00	Fn BldTD		
Total	-1,273	.0			Auxil		0	0	нtд	Btuh/SqFt	-41.44	Fn Frict	0.0	0.0

System 2 Peak SZ - SINGLE ZONE

Peaked at	****** : Time =		Mo/Hr:				*	Ma	/Hr:	8/16		Mo/Hr:		
Outside A	\ir ==>	OA		96/ 63/ 49.	0		*		DADB:	-		OADB:	0	
							*			•	•			
		Space	Ret. Air	Ret. Air	Ne	et Perc	nt *	:	Space	Percnt 1	Space F	eak Coil	Peak	Perci
		Sens.+Lat.	Sensible	Latent	Tota	al Of T	ot *	Sens	ible	Of Tot	Space S	Sens Tot	Sens	Of To
Envelope		(Btuh)	(Btuh)	(Btuh)	(Btul	1) (1	%) *	(E	(tuh	(%)	' (Bt	tuh) (Btuh)	C
Skylite		0	C	t		0 0.	00 *		0	0.00	*	0	0	0.0
Skylite		0	C	1		0 0.	00 *		0	0.00	+	0	0	0.0
Roof Co		0	C	1		0 0.	00 *		0	0.00	•	0	0	0.0
Glass S	Colar	14,496	C	1	14,49	P6 26.	59 *	14	,496	29.25	•	0	0	0.0
Glass C	ond	5,990	0	1	5,99	0 10.	99 *	5	,990	12.09	•	0	0	0.0
Wall Co	ond	19,625	0	1	19,62	25 36.	* 00	19	,625	39.61	•	0	0	0.0
Partiti	on	-1,945			-1,94	5 -3.	57 *	-1	,945	-3.93		0	0	0.0
Exposed	l Floor	0				0 0.	00 *		0	0.00	r	0	0	0.0
Infiltr	ation	0				0 0.	oo *		0	0.00	•	0	0	0.0
Sub Tot	al==>	38,166	0	ı	38,16	66 70.	02 *	38	, 166	77.02	•	0	0	0.0
Internal	Loads						*				•			
Lights		28,409	0		28,40	9 52.	12 *	28	,409	57.33 *	•	0	0	0.0
People		4,200			4,20	0 7.	71 *		,300	4.64		0	0	0.0
Misc		0	0	0		0 0.	00 *		0	0.00		0	0	0.0
Sub Tot	al==>	32,609	0	0	32,60	9 59.	83 *	30	,709	61.97 *		0	0	0.0
Ceiling L	oad	0	0			0 0.	00 *		0	0.00 *		0	0	0.0
Outside A	ir	0	0	0	. 65	6 1.	20 *		0	0.00 *	•	0	0	0.0
Sup. Fan	Heat				2,40	0 4.	40 *			0.00 *	1		0	0.0
Ret. Fan	Heat		0			0 0.	00 *			0.00 *	•		0	0.0
Duct Heat	Pkup		0			0 0.0	00 *			0.00 *	,		0	0.0
OV/UNDR S	izing	-19,324			-19,32	4 -35.4	45 *	-19	.324	-39.00 *		0	0	0.0
Exhaust H	eat		0	0		0 0.0	00 *			0.00 *			0	0.0
Terminal	Bypass		0	0		0 0.0	00 *			0.00 *			0	0.0
							*			*				
Grand Tot	al==>	51,451	0	0	54,50	6 100.	00 *	49	,551	100.00 *		0	0	0.0
	•••	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	coo	LING COIL SE	LECTION					••••		AREAS		
	Total	_		Coil Airfl		ing DB/	√B/HR	Lea	ving D	B/WB/HR	Gross To		ass (sf)	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F D	eg F G	rains	Deg F	Deg F	Grains	Floor	3,784		
ain Clg	5.0	60.0	58.2	2,250	78.4	59.3	57.2	53.9	48.9	51.9	Part	838		
ıx Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Exflr	0		
ot Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	0		0
otals	5.0	60.0									Wall	2,884	30	2 1
	HEATI	NG COIL SELE	CTION	•••••	А	IRFLOWS	(cfm)			ENGINEER ING	CHECKS	TEMPE	RATURES	(F)
	Capaci	ty Coil Ai	rfl Ent	Lvg	Type	Coolir	ng	Heating		g % OA	2.5	Type	Clg	Htg
	(Mbh) (cfn) Deg F	Deg F	Vent		6	0		g Cfm/Sqft	0.59	SADB	55.0	0.0
ain Htg	-0	.0	0.0	0.0	Infil		0	0		g Cfm/Ton	450.00	Plenum	78.0	0.1
ıx Htg	0	.0	0.0	0.0	Supply	2,25	0	0		g Sqft/Ton	756.70	Return	78.0	0.1
eheat	-0	.0 2,2	50 0.6	53.9	Mincfm	-	0	0		g Btuh/Sqft		Ret/OA	78.4	
eheat	0	.0	0.0	0.0	Return	2,25		0		. People	10.88	Runarnd	78.0	0.
midif	0	.0	0.0	0.0	Exhaust		6	0		. георге 3 % ОА	0.0	Fn MtrI		0.
t Vent		.0	0.0		Rm Exh		0	0		g Cfm/SqFt	0.00	Fn BldTi		0.0

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

System Totals

Percent	Cool	ing Loa	d	Heatin	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.		Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.8	11	378	-63,650	22	628	332.5	0	0	0.0	0	0
5 - 10	1.6	11	364	-127,300	19	557	665.0	0	0	0.0	0	0
10 - 15	2.4	9	291	-190,950	11	305	997.5	0	0	0.0	0	0 _
15 - 20	3.2	8	287	-254,600	11	325	1,330.0	0	0	0.0	0	0
20 - 25	4.0	7	247	-318,250	14	395	1,662.5	0	0	0.0	0	0
25 - 30	4.8	8	282	-381,900	11	304	1,995.0	0	0	0.0	0	0
30 - 35	5.6	7	242	-445,550	7	196	2,327.5	1	49	0.0	0	0
35 - 40	6.4	8	287	-509,200	5	150	2,660.0	0	0	0.0	0	0
40 - 45	7.2	8	262	-572,850	0	0	2,992.5	0	0	0.0	0	0
45 - 50	8.0	9	291	-636,500	0	0	3,325.0	0	0	0.0	0	0
50 - 55	8.8	4	150	-700,150	0	0	3,657.5	0	0	0.0	0	0
55 - 60	9.6	3	108	-763,800	0	0	3,990.0	0	0	0.0	0	0
60 - 65	10.4	4	151	-827,450	0	0	4,322.5	0	0	0.0	0	0
65 - 70	11.2	2	63	-891,100	0	0	4,655.0	12	436	0.0	0	0
70 - 75	12.0	0	0	-954,750	0	0	4,987.5	0	0	0.0	0	0
75 - 80	12.8	0	0	-1,018,400	0	0	5,320.0	0	0	0.0	0	0
80 - 85	13.6	0	0	-1,082,050	0	0	5,652.5	0	0	0.0	0	0
85 - 90	14.4	0	0	-1,145,700	0	0	5,985.0	0	0	0.0	0	0
90 - 9 5	15.2	0	0	-1,209,350	0	0	6,317.5	0	0	0.0	0	0
95 - 100	16.0	0	0	-1,273,000	0	0	6,650.0	86	3,079	0.0	0	0
Hours Off	0.0	0	5,357	0	0	5,900	0.0	0	5,196	0.0	0	8,760

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MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

------ MONTHLY ENERGY CONSUMPTION ----------------

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	19,290	87	2,983	11
Feb	17,441	87	2,273	10
March	19,848	87	549	6
April	15,087	107	3	1
May	29,045	143	0	0
June	37,700	146	0	0
July	39,990	146	0	0
Aug	39,532	146	0	0
Sept	28,311	141	0	0
Oct	19,789	138	0	0
Nov	18,380	87	675	5
Dec	18,690	87	2,101	9
Total	303,102	146	8,584	11

Building Energy Consumption = Source Energy Consumption =

61,615 (Btu/Sq Ft/Year) 62,479 (Btu/Sq Ft/Year) Floor Area = 30,722 (Sq Ft)

D7-10

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ESOS STUDY AT WSMR - BUILDING 124
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
MODIFY HTG CONTROLS: ALT 1-BSLN,ALT2-ECO (ECO# 90)

Weather File Code:

ELPASO.W

Location:

Latitude: 31.0 (deg)
Longitude: 106.0 (deg)
Time Zone: 6

Elevation: 3,918 (ft)

Barometric Pressure: 25.8 (in. Hg)

Summer Clearness Number: 1.00
Winter Clearness Number: 1.00
Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20

Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run:

1:43:17 1/24/92

Dataset Name:

124A .TM

System 1 Block RAD - RADIATION

Mo/Hr: 13/ 1 Mo/Hr: 0/ 0 Mo/Hr: 0/ 0 Peaked at Time ==> OADB: 24 OADB: 0 OADB/WB/HR: 0/ 0/ 0.0 Outside Air ==> Percnt * Coil Peak Percnt Space Peak Space Net Percnt Ret. Air Ret. Air Space Of Tot * Tot Sens Of Tot Space Sens Of Tot Sensible Total Sensible Latent Sens.+Lat. (Btuh) (Btuh) (%) (Btuh) (%) (%) (Btuh) (Btuh) (Btuh) (Btuh) Envelope Loads 0.00 0 0.00 0 0.00 0 n 0 Skylite Solr 0 0.00 0 0 0.00 0.00 0 0 0 Skylite Cond 0.00 -62,015 -62,015 6.36 0 0 0.00 0 0 Roof Cond 0.00 * O 0 0.00 0 0 0.00 0 0 Glass Solar 37.81 0.00 * -368,581 -368,581 0.00 0 0 0 Glass Cond 0 0.00 * -196,698 -196,698 20.18 0.00 0 0 Wall Cond 0.00 * 0 0 0.00 n 0 0.00 O Partition 0 0.00 0.00 * 0 0.00 0 0 0 Exposed Floor -347,648 35.66 0.00 * -347,648 0.00 a n 0 Infiltration 0.00 -974,942 -974,942 100.00 0 0.00 0 n Sub Total==> Internal Loads 0 0.00 n 0 0.00 0 0.00 Lights 0 0 0.00 0.00 n n 0 0.00 0 0 People 0.00 0.00 0 0 0.00 0 0 0 0 0 Misc 0.00 0.00 n 0.00 Ω 0 0 Sub Total ==> 0 0.00 0.00 0.00 O 0 n Ceiling Load 0 0.00 ٥ 0.00 0 0.00 n 0 Outside Air 0.00 0.00 0.00 0 Sup. Fan Heat 0 0.00 0.00 0.00 0 Ret. Fan Heat 0 0.00 0.00 0.00 0 0 Duct Heat Pkup 0.00 0 0 0.00 n n OV/UNDR Sizing 0.00 0 0.00 n Exhaust Heat 0 0.00 0.00 0 0.00 n Terminal Bypass -974,942 -974,942 100.00 0.00 * 0.00 * 0 0 Grand Total ==> -----AREAS----------COOLING COIL SELECTION-----Glass (sf) (%) Leaving DB/WB/HR Entering DB/WB/HR **Gross Total** Total Capacity Sens Cap. Coil Airfl 40,046 Deg F Deg F Grains Floor Deg F Deg F Grains (Mbh) (Mbh) (Tons) 18,194 0.0 0.0 Part 0.0 0.0 0.0 0.0 0.0 ٥ 0.0 0.0 Main Clg 0 0.0 Exflr 0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Aux Clg 0.0 13,348 0 0 0.0 0.0 0.0 Roof n 0.0 0.0 0.0 0.0 0.0 0.0 Opt Vent Wall 22,202 6,365 Totals 0.0 0.0 -----AIRFLOWS (cfm)-------- ENGINEERING CHECKS---- TEMPERATURES (F)--------HEATING COIL SELECTION-----0.0 Clg Htg Cooling Heating Clg % OA Type Capacity Coil Airfl Type Ent Lva 70.1 SADB 0.0 0 0 Clg Cfm/Sqft 0.00 (cfm) Deg F Deg F Vent (Mbh) 70.0 7,893 Clg Cfm/Ton 0.00 Plenum 0.0 Infil 0 0.0 -1,798.4 0 0.0 Main Htg n 0 Clg Sqft/Ton 0.00 Return 0.0 70.0 0 0.0 0.0 Supply 0.0 Aux Htg 0.0 70.0 n 0 Clg Btuh/Sqft 0.00 Ret/OA Mincfm 0 0.0 0.0 Preheat 0.0 70.0 0 0 No. People 0 Runarnd 0.0 Return O 0.0 Reheat 0.0 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0 0.0 0.0 Exhaust Humidif 0.0 0 Htg Cfm/SqFt 0.00 Fn BldTD 0.0 0.0 n 0.0 0.0 0.0 Rm Exh Opt Vent Htg Btuh/SqFt -44.91 Fn Frict Auxil -1,798.4 Total

.

interiories

D7-12

System	2	Peak	PTAC	- PACKAGE	ED TERMINA	AL AIR	COND.							
*****	*****	******	COOLING COIL	PEAK ****	******	*****	*****	***** CLG	SPACE	PEAK ****	****** HE	EATING COIL	PEAK **	*****
Peaked a	at Time :		Mo/Hr:				•			7/16 . 1	*	Mo/Hr:		
Outside	Air ==>	0/	ADB/WB/HR:	97/ 64/ 49.	.0		4	, 0	ADB:	97 1	*	OADB:	0	
							•			•	•			
		Space	Ret. Air	Ret. Air	i	Net Pe	rcnt *	· s	pace	Percnt 1	* Space F	Peak Coil	Peak	Percnt
		Sens.+Lat.	Sensible	Latent	Tot	tal Of	Tot *	' Sens	ible	Of Tot 1	Space S	Sens Tot	Sens	Of Tot
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Bti	uh)	(%)	' (B	tuh)	(%)	* (Bt	tuh) (E	Stuh)	(%)
Skylit	e Solr	0	0			0 (0.00 *	•	0	0.00	t	0	0	0.00
Skylit	e Cond	0	0			0 (0.00	•	0	0.00	•	0	0	0.00
Roof C	ond	0	0			0 (0.00 *	•	0	0.00	*	0	0	0.00
Glass	Solar	11,664	0		11,6	564 2	2.99 *	11	,664	25.38 4	+	0	0	0.00
Glass	Cond	9,456	0		9,4	456 18	8.63 *	9	,456	20.57		0	0	0.00
Wall C	ond	6,579	0		6,5	579 17	2.97 *	6	,579	14.31	•	0	0.	0.00
Partit	ion	0				0 (0.00 *	,	0	0.00	•	0	0	0.00
Expose	d Floor	0				0 (0.00 *	,	0	0.00	t	0	0	0.00
Infilt	ration	0				0 (0.00 *	,	0	0.00	•	0	0	0.00
Sub To	tal==>	27,698	0		27,6	598 54	4.59 *	27	,698	60.27	•	0	0	0.00
Internal	Loads						*	•		1	•			
Lights	,	10,614	0		10,6	514 20	.92 *	10	,614	23.09	•	0	0	0.00
People	•	2,100			2,1	100 4	4.14 *	1	, 150	2.50	•	0	0	0.00
Misc		0	0	0		0 (0.00 *		0	0.00	·	0	0	0.00
Sub To	tal==>	12,714	0	0	12,7	714 25	.06 *	11	,764	25.60	•	0	0	0.00
Ceiling	Load	0	0			0 (0.00 *		0	0.00	•	0	0	0.00
Outside .	Air	0	0	0	3,1	120 6	5.15 *		0	0.00	•	0	0	0.00
Sup. Fan	Heat				7	711 1	1.40 *			0.00 *	r		0	0.00
Ret. Fan	Heat		0			0 (.00 *			0.00	r		0	0.00
Duct Hea	t Pkup		0			0 (0.00 *			0.00 *	,		0	0.00
OV/UNDR	Sizing	6,497			6,4	97 12	2.80 *	6	,497	14.14 *	,	0	0	0.00
Exhaust	Heat		0	0		0 (.00 *			0.00 *	•		0	0.00
Terminal	Bypass		0	0		0 (.00 *			0.00 *			0	0.00
							*			*	•			
Grand To	tal==>	46,910	0	0	50,7	42 100	.00 *	45	,960	100.00 *	•	0	0	0.00
900000000		******	C00	LING COIL S	ELECTION-						******	AREAS-		
	Total	Capacity	Sens Cap.	Coil Airfl	Ente	ring DE	/WB/HR	Leav	ving DE	B/WB/HR	Gross To		ss (sf)	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F	Deg F	Grains	Deg F	Deg F	Grains	Floor	1,555	,,	,
Main Clg	5.0	60.0	59.5	2,000	80.0	58.9	52.5		46.9	44.3	Part	0		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	0		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0		0.0	0.0	Roof	0		0 0
Totals	5.0	60.0									Wall	1,321	43	
	HEATI	NG COIL SEL	ECTION	•••••		AIRFLOL	S (cfm)	F	NGINEERING	CHECKS"	TEMPER	ATUDEO	(5)
	Capaci			Lvg	Туре	Cool		, Heating		% OA	9.8			
	(Mbh			Deg F	Vent		195	0		Cfm/Sqft	1.29	Type SADB	Clg 54.0	Htg
Main Ktg		.0	0 0.0	0.0	Infil		0	0		Cfm/Ton	400.00	Plenum	78.0	0.0
Aux Htg	0	.0	0.0	0.0	Supply	2.	000	0		Sqft/Ton	311.00			0.0
Preheat	-0		000 2.3	53.6	Mincfm	-,	0	0	_	Sqrt/ron Btuh/Sqft		Return	78.0	0.0
Reheat		.0	0 0.0	0.0	Return	2	000	0		People	30.39 5	Ret/OA	79.9	0.0
Humidif		.0	0.0	0.0	Exhaust		195	0		% OA		Runarnd	78.0	0.0
Opt Vent		.0	0 0.0	0.0	Rm Exh		0	0			0.0	Fn MtrTD	0.1	0.0
Total		.0			Auxil		0	0		Cfm/SqFt	0.00	Fn BldTD	0.1	0.0
	·				MUNIC		U	U	ntg	Btuh/SqFt	0.00	Fn Frict	0.2	0.0

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

System Totals

Percent	Cool	ing Load	d	Heati	ng Load		Cooling	Airflow		Heating		
Design	Cap.	Hours	- Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.3	9	198	-89,921	35	758	100.0	0	0	0.0	0	0
5 - 10	0.5	7	164	-179,842	12	269	200.0	0	0	0.0	0	0
10 - 15	0.8	10	230	-269,763	13	277	300.0	0	0	0.0	0	Q
15 - 20	1.0	6	141	-359,684	14	295	400.0	0	0	0.0	0	0
20 - 25	1.3	7	170	-449,605	14	307	500.0	0	0	0.0	0	0
25 - 30	1.5	9	205	-539,526	12	259	600.0	0	0	0.0	0	0
30 - 35	1.8	10	235	-629,447	0	0	700.0	0	0	0.0	0	0
35 - 40	2.0	7	169	-719,368	0	0	800.0	0	0	0.0	0	0
40 - 45	2.3	9	204	-809,289	0	0	900.0	0	0	0.0	0	0
45 - 50	2.5	9	196	-899,210	0	0	1,000.0	0	0	0.0	0	0
50 - 55	2.8	7	166	-989,131	0	0	1,100.0	0	0	0.0	0	0
55 - 60	3.0	3	66	-1,079,052	0	0	1,200.0	0	0	0.0	0	0
60 - 65	3.3	5	108	-1,168,973	0	0	1,300.0	0	0	0.0	0	0
65 - 70	3.5	2	43	-1,258,894	0	0	1,400.0	0	0	0.0	0	0
70 - 75	3.8	0	0	-1,348,815	0	0	1,500.0	0	0	0.0	0	0
75 - 80	4.0	0	0	-1,438,736	0	0	1,600.0	0	0	0.0	0	
80 - 85	4.3	0	0	-1,528,657	0	0	1,700.0	0	0	0.0	0	
85 - 90	4.5	0	0	-1,618,578	0	0	1,800.0	0	0	0.0	0	
90 - 95	4.8	0	0	-1,708,499	0	0	1,900.0	0	0	0.0	0	
95 - 100	5.0	0	0	-1,798,420	0	0	2,000.0	100	2,312	0.0	0	
Hours Off		0		0	0	6,595	0.0	0	6,448	0.0	0	8,760

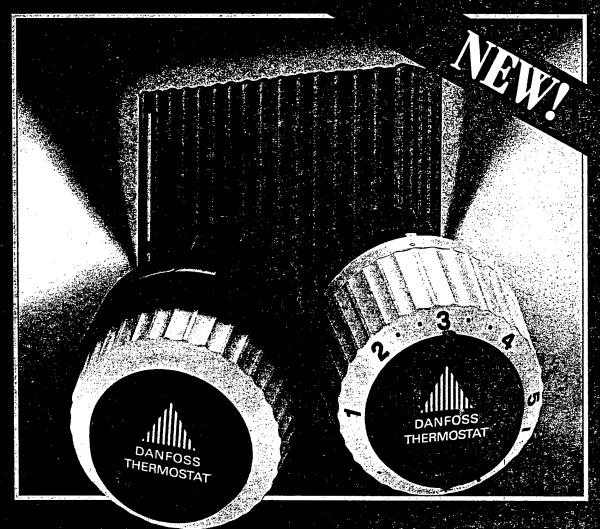
imministration (b)

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

M O N T H	LY ENERGY	' CONSUMPTION	

	ELEC .	DEMAND	GAS	GAS DMND	
	On Peak	On Peak	On Peak	On Peak	
Month	(k\h)	(kW)	(Therm)	(Thrm/hr)	
Jan	17,002	85	2,557	12	
Feb	15,293	85	1,952	11	
March	17,398	85	472	7	
April	15,143	83	0	2	
May	17,761	99	0	0	
June	18,988	100	0	0	
July	18,367	100	0	0	
Aug	19,749	100	0	0	
Sept	16,440	98	0	0	
Oct	16,518	97	0	0	
Nov	15,530	85	442	5	
Dec	16,173	85	1,690	9	
Total	204,363	100	7,112	12	
Building Energy		_	63 (Btu/Sq		
Source Energy Co	onsumption	= 34,3	92 (Btu/Sq	Ft/Year)	

Thermostatic Radiator Valves



Improve heating system balance, comfort, and fuel efficiency.

D7-17

Danfoss

DANFOSS RA 2000... loaded with smart features and benefits at a very reasonable price.

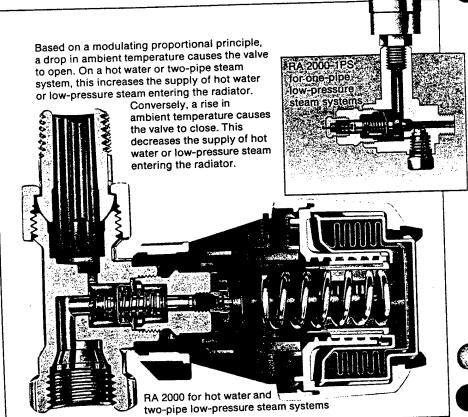
The Danfoss RA 2000 is your best thermostatic radiator valve buy, for several reasons:

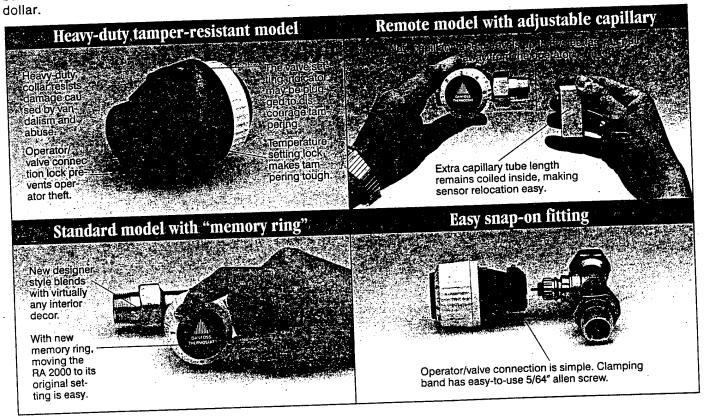
RA 2000 thermostatic radiator valves utilize the latest vapor-filled bellows system from Danfoss, the trusted worldwide leader in thermostatic radiator valves for over 30 years.

RA 2000 installation is easy, thanks to (A) the rugged snap-on fitting of the operator to the valve and (B) the convenient choice of straight, angle, sidemount, and unique one-pipe steam valves. The adjustable capillary streamlines remote sensor installation, too.

For the building owner and tenant, RA 2000 thermostatic radiator valves feature a designer-style look; an improved maximum/minimum temperature limit and lock; and an easy-to-use memory ring. A special tamper-resistant model with heavy-duty collar, setting lock, and operator/valve connection lock is available for applications where vandalism and abuse are primary concerns.

Add the dramatic improvement in hot water, one- or two-pipe low-pressure steam heating system balance, comfort, and fuel efficiency, and the RA 2000 becomes an exceptional value for the dollar.





DANFOSS RA 2000... backed by over 30 years of worldwide TRV engineering experience.

It's no secret that, over the past 30 years, the need for high-efficiency, economical heating systems has been more acute in Europe than in North America. Hence, there has been more of a consistent, long-term incentive for manufacturers, like Danfoss, to invest time and money in product research and development.

Unlike other, newer TRV brands on the market, Danfoss enjoys a reputation as the best TRV manufacturer in the world, with literally millions of valves operating in buildings around the world. By investing in Danfoss TRVs, you benefit from this wealth of laboratory and application engineering experience.

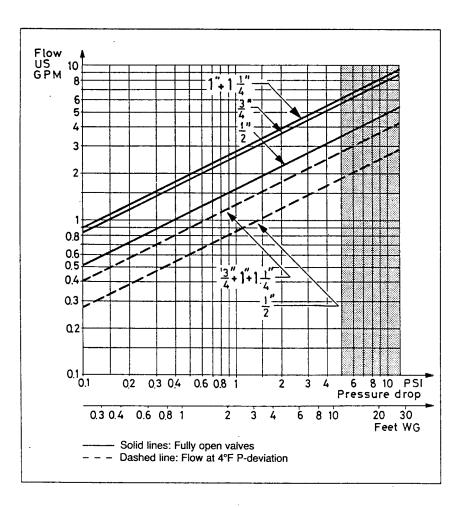
Danfoss supports you with an extensive network of local distributors, regional representatives, and full-time Danfoss hydronic heating specialists based in our local head-quarters.

What's the bottom line? Danfoss RA 2000 TRVs are engineered, tested, and manufactured for top quality...quality you can rely upon for all your residential, commercial, or institutional hydronic heating system needs to the year 2000 and beyond.

Important

P-deviation refers to the difference between the thermostat setting and the actual sensor temperature (i.e. room temperature). For best comfort and long life, valves should be selected which provide the design heating load at approximately a 4°F P-deviation.

	Max. test pressure	Max. static pressure	Max. sensor temperature	Max. diff. pressure (hot water)	Temp. range	Max. steam pressure
Hot water & 2-pipe LPS	232 psi (536 ft.)	145 psi (335 ft.)	140°F″	20 psi (46 ft.)	43-82°F	15 psig
1-pipe LPS			140°F		43-82°F	15 psig



Quick reference capacity chart for RA 2000 valves for 2-pipe low-pressure steam and hot water.

Pressure drop P-deviation °F			1 psi (2.3 ft.)		2 psi (4.6 ft.)		3 psi (6.9 ft.)		4 psi (9.2 ft.)		15 psi (34.6 ft.)		
		4	fully open	4	fully open	4	fully	4	fully open	4	fully open		
Valve size	Rating code												
12" 34" 1" + 11/4"	MBh MBh MBh	10 15 18	16 30 40	14 20 25	22 40 52	16 28 30	28 50 60	20 32 36	32 58 72	35 60 66	62 108 140		

Hot water capacity is based on a 20°F temp. drop through radiation where 1 gpm flow = approx. 10,000 Btu/h

Note: Use shaded area for quick sizing method only. For more detailed information about valve selection refer to RA 2000 engineering data sheet.

To convert: psi to feet of head = psi x 2.31 ● Feet of head to psi = feet of head x 0.433 ● Sq. ft. EDR to Btu/h = sq. ft. EDR x 240 (steam).

• Btu/h to sq. ft. EDR = Btu/h ÷ 240 • One MBh = 1.000 Btu/h. • EDR = Equivalent Direct Radiation.

DANFOSS RA 2000... easy to order and available today with all the accessories you need.

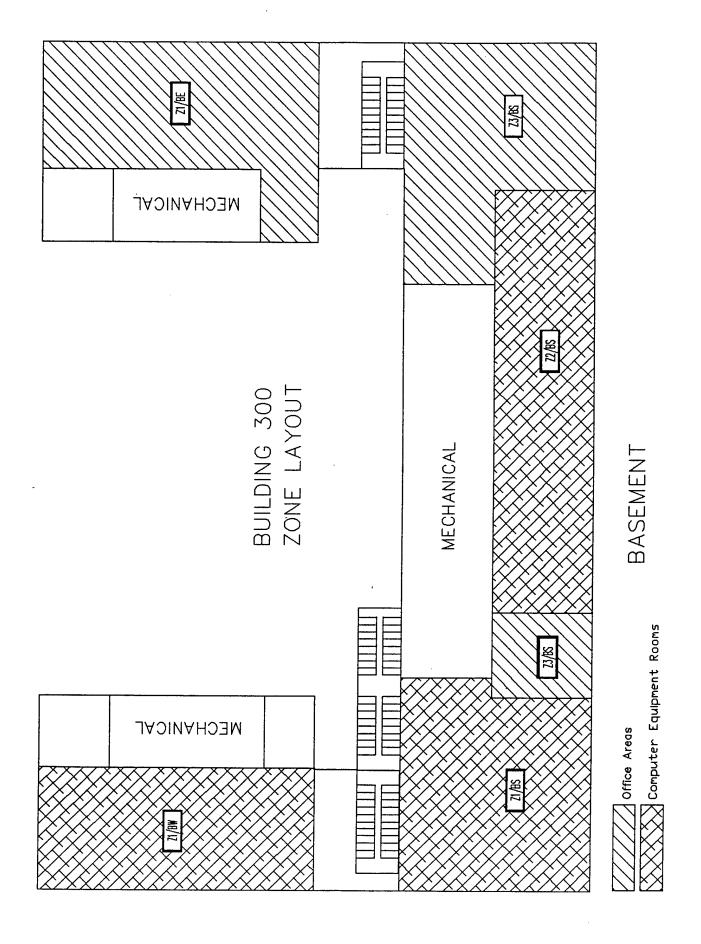
		_	Operators
		Ŀ	Capillary tube length
			50 26 3 3 6 3 3 3 5 5 6
		<u> </u>	
The second section of the section of the second section of the section of t			3013C8265
Configurations	Connection 3 & 4	C	013G8200 013G8200 013G8015
	1/2" NPT	1.6	013G8020
	3/4" NPT	2.7	013G8025
	1" NPT	2.8	- 1、1 まye 1 - 1、1、1、1、1 - 1 - 1 - 1 - 1 - 1 - 1 -
	11/4" NPT	2.8	013G8032 013G8014
	1/2" NPT	1.6	27.5
	3/4" NPT	2.7	013G8019
	34 NPT	2.8	013G8024
	11/4" NPT	2.8	013G8031
	1/4 NPT	1.6	- 013G8013
	3/4" NPT	2.7	013G8018
oco:	1" NPT	2.8	013G8023
	11/4" NPT	2.8	013G8030
		10000	013G8042
	1/2" Double Solder union	1.6	
rn ∂ m	3/4" Double	7	013G8044
(H)	Solder union	2.7	
	- 00 Post 188		
			013G0140
	1/8" NPT		
1 4 3 4	10000000000000000000000000000000000000		

Parts ar	nd accessories						d.
Configuration : [Description 2000					14.75	
	Tool set			- 013G1236			
80	Limitation pins		-013G1237			a south	
2222	Cover plug			013G1232			
	for locking screw Cover plate, for temp. limitations	013G1235		*013G1235			
	Cover plate for scale		013G1233	Land College College			
	Staple gun			013L1239	Continue Continue	The second second	
-	Packing gland for valves			013G0290	1947		
Programmand .	Sensor guard				013-0030		
	2500				013-7064		
	Tamper kit					,013X1145	013X1145
	°F dial	St. 50		013L8011		2.60	
	1-pipe steam Air vent Brass 45° street elbow			Company of the second	013L8300		
	for convector applications (order 2 pcs. per 1PS val	ve)	D7-7	<u>10</u>	Respondent lines	A. Carlotte Services	為[46] 公路為 1673

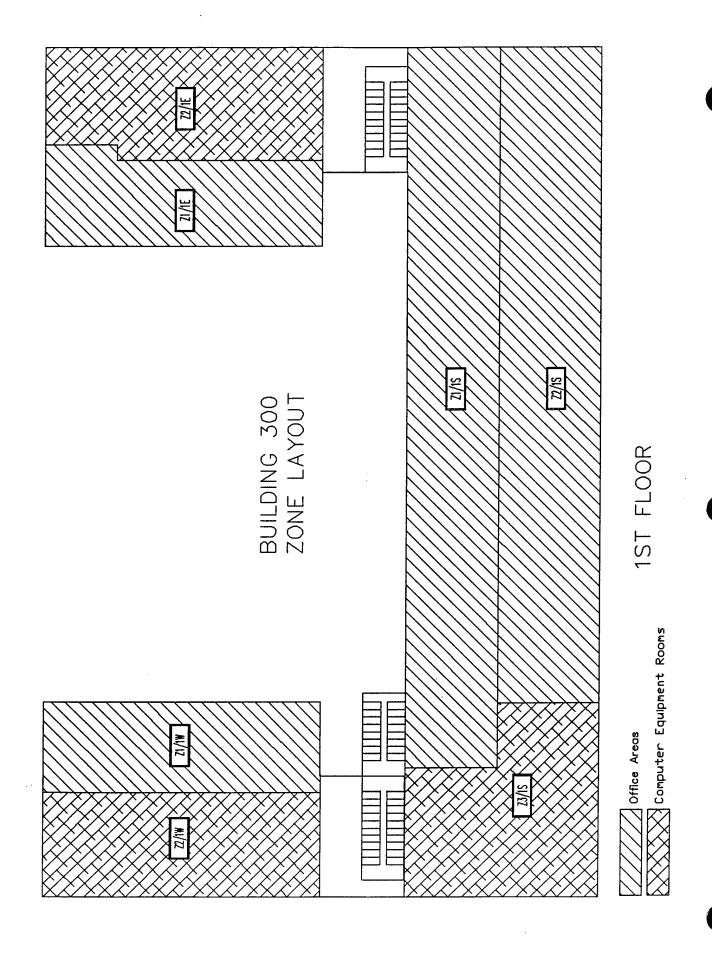
LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

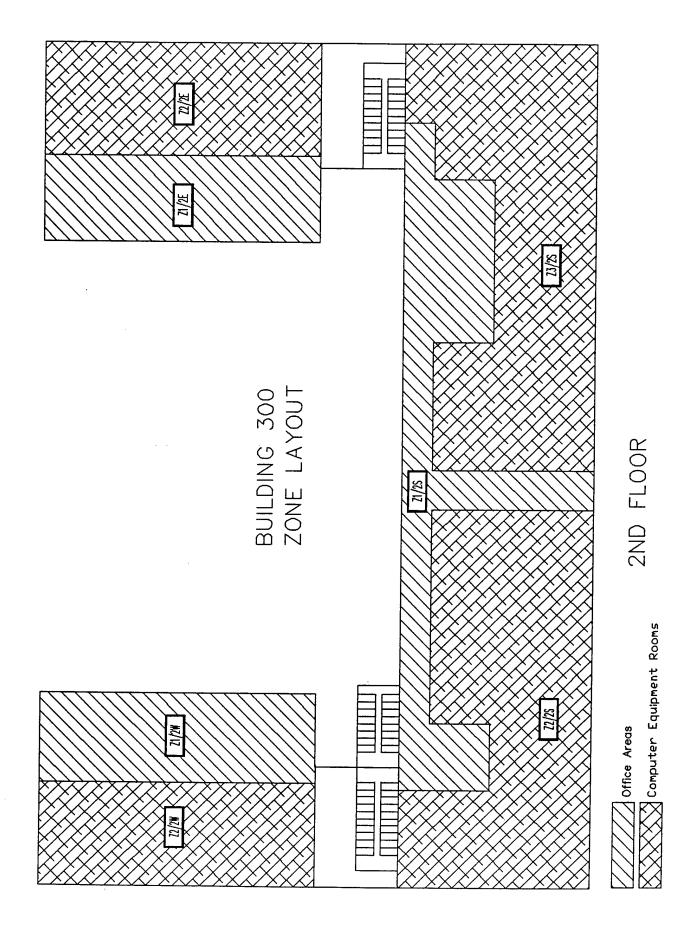
		•						
		LOCATION: Whit	e Sands Missile F	Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	BLDG. 300 - EN	NERGY EFFICIENT LIG	SHTING		FISCAL YEAR:	1992
		DISCRETE PORTIC	ON NAME: T	OTAL				
		ANALYSIS DATE:	06/23/92		ECONOMIC LIFE:	25	PREPARED BY:	A. NIEMEYER
1	IN۱	/ESTMENT						
	A.	CONSTRUCTION	COST	-			\$38,783	
	B.	SIOH COST		(5.5% of 1A) =			\$2,133	
	C.	DESIGN COST		(6.0% of 1A) =			\$2,327	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$ 43,24 3	
	E.	SALVAGE VALUE					\$0	
		TOTAL INVESTME	NT	(1D - 1E) =			>	\$43,243
	•	, , , , , , , , , , , , , , , , , , ,		(12 12)			-	4.0,2.10
2	FN	ERGY SAVINGS (+)	/COST (~)					
_	,	FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
		TOLLTITLE	\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	Α	ELEC	\$6.48	208	\$1,345	15.23	\$20,485	
		DIST	40.40	208	\$1,549	17.28	\$0	
		NAT GAS	\$2.21		·			
			4 2.21	(18)	-	19.64	(\$787)	
		PAPER		0	\$0	40.00	\$0	
		COAL		400	\$0	16.22	\$0	***
	r.	TOTAL		190	1,305.0		>	\$19,698
•		N ENERGY GAVIN	00())(0007()					
3		N-ENERGY SAVIN					A E A E A E	
	A.			DEMAND SAVINGS)	/C T A A	44.00	\$5,909	
		1 DISCOUNT FAC		OT ()	(From Table A-2) =	14.68	444 747	
	_	2 DISCOUNTED S		S1 (-)	(3A x 3A1) =		\$86,737	
	ъ.	NON-RECURRING	a (+/ -)			*****		
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		C.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENE	RGY DISCOUNT	ED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$86,737
	D.	PROJECT NON-E	NERGY TEST					
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$6,500	
		a IF 3D1 => 3C 1	THEN GO TO 4					
		b IF 3D1 < 3C T	HEN CALCULATI	E SIR	,	(2F5 + 3D1) / 1F =	0.61	
		c IF 3D1b => 1 7	THEN GO TO 4					
		d IF 3D1b < 1 Th	HEN PROJECT D	OES NOT QUALIFY				
4	Elc	RST YEAR DOLLAR	SAVINGS (1) (C	OSTS (_)	(050	. 28 . /204 4/05%		** 0.4 0
		OTAL NET DISCOUN		CG1G(-)	(2F3	+ 3A + (3B1d/25)) =		\$7,213 \$108,425
				AENT DATIO (OID)		(2F5 + 3C) =		\$106,435
0		SCOUNTED SAVING		- ,		(5/1 F) =		2.46
_		F SIR < 1 THEN PRO		T QUALIFY)		,		
1	Sil	MPLE PAYBACK (SF	1 5)			(1F/4) =		5.99

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NMC							
CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SOU	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO	ORTH BLVI	D., #C-200,	DENVER, C	, 0 80227	
CONTRACT F	CONTRACT FOR (Work to be performed) ENERGY EFFICIENT LIGHTING IN BLDG. 300	300					PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE R	PURCHASE RECULEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
				MATERIAL COST	LCOST		LABOR COSTS			
Line	tem	ž č	Quantity			Manhours	Average		Other Direct	Líne
Š.	Ξ	Measure (2)	ව	G Git	Total (5)	Mandays (6)	Rate	Total (8)	Costs (9)	Total (10)
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	1652	2.19	3617.88	0.09	27.60	4012.38		\$7,630.26
	ENERGY EFFICIENT BALLASTS	Ē	808	14.06	11360.48	0.85	27.60	18977.98		\$30,338.46
	DIMMING BALLASTS	EA	18	21.75	391.50	0.85	27.60	422.78		\$814.28
	TOTAL THIS SHEET									\$38,783.00
	Henrich Courses Historic County of the County of the Land of the L		9			Designa No Mades 4				



D8-3





ESOS STUDY AT WSMR - BUILDING 300
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
RANGE CONTROL BLDG ALT 1-BSLN, ALTZ-ECO-

Weather File Code:

ELPASO.W

Location:

Latitude:

31.0 (deg)

Longitude:

106.0 (deg)

Time Zone:

6

Elevation:

ប្រជាជា

3,918 (ft)

Barometric Pressure:

25.8 (in. Hg)

Summer Clearness Number:

1.00

Winter Clearness Number:

1.00

Summer Design Dry Bulb:

98 (F)

Summer Design Wet Bulb:

64 (F)

Winter Design Dry Bulb:

24 (F)

Summer Ground Relectance: Winter Ground Relectance:

0.20 0.20

Air Density:

0.0653 (Lbm/cuft)

Air Specific Heat:

0.2444 (Btu/lbm/F)

Density-Specific Heat Prod:

0.9575 (8tu-min./hr/cuft/F)

Latent Heat Factor:

4,214.8 (Btu-min./hr/cuft)

Enthalpy Factor:

3.9171 (Lb-min./hr/cuft)

Design Simulation Period: January To December System Simulation Period: January To December

Cooling Load Methodology:

TETD/Time Averaging

Time/Date Program was Run:

18: 5:50 3/13/92

Dataset Name:

300 .TM

DD

- DOUBLE DUCT

1 Block

System

a estil

PAGE 3

System	•	Brock		DOOBLE	,									
*****	*****	******	COOLING COIL	PEAK ****	*****	*****	*****				******			*****
Peaked a	at Time =		Mo/Hr:	•			*	Mo	o/Hr:		*		r: 13/ 1	
Outside	Air ==>	OA	NDB/WB/HR:	97/ 64/ 49.	.0		*	(DADB:	97	*	OAD	B: 24	
		Space	Ret. Air	Ret. Air	N	let Per	cnt *	,	Space	Percnt	* Space	Peak Co	oil Peak	Percnt
		Sens.+Lat.	Sensible			al Of			sible	Of Tot	•		Tot Sens	Of Tot
Envolone		(Btuh)	(Btuh)		(Btu		(%) *		Stuh)	(%)	•	Stuh)	(Btuh)	(%)
Envelope	e Solr	(8641)	(BCGI)		(500		.00 *	,,	0	0.00		0	0	0.00
	e Cond	0	(.00 *		0	0.00		0	0	0.00
Roof C		0	12,734		12,7		.70 *		0	0.00		0	-13,550	3.56
Glass		0	(2,13		,.		.00 *		0	0.00		0	0	0.00
Glass		0	Ċ				.00 *		0	0.00		0	0	0.00
Wall C		81,136	27,781		108,9		.06 *	81	1,117	28.85		-	173,237	45.46
Partit		-4,965	21,10	!	-4,9		.05 *		,965	-1.77		, 134	-60,134	15.78
		0			7,7		.00 *	,	0	0.00		0	0	0.00
• • • • • • • • • • • • • • • • • • • •	d Floor	_			4.1		.31 *	7	7,886	2.80		,848	-14,848	3.90
	ration	6,185	/O E4E		6,1		.01 *		,038	29.88			261,770	68.69
	tal==>	82,355	40,515	•	122,8	71 20	.01 *	0-	,050	27.00	£03	,,,,,,	201,110	00.07
Internal		/O 7/4			40.7	/4 42		40	7/1	21.46		0	0	0.00
Lights		60,341	C	,	60,3		.77 *		341	5.32	•	0	0	0.00
People	:	27,300			27,3		.78 *		,950 ,877	36.94		0	0	0.00
Misc	A . 1	103,877	0	_	103,8		.99 *		•	63.71		0	0	0.00
	tal==>	191,518	7 001		191,5		.54 *		7,168 3,230	1.15		,628	0	0.00
Ceiling		3,991	-3,991	_	(2.2		.00 *		,,230 0	0.00		•	149,417	39.21
Outside .		0	0	0	62,2		.18 *		U	0.00			84,211	-22.10
Sup. Fan			•		84,2		.83 * .00 *			0.00			04,211	0.00
Ret. Fan			0				.00 *			0.00			0	0.00
Duct Hea		4/ 770	0	l	4/ 7		.00 *	4/	770	5.25		,220	-58,220	15.28
OV/UNDR	-	14,770	7 250	•	14,7		.13 *	14	,770	0.00		, 220	4,116	-1.08
Exhaust			-3,250		-3,2		.69 * .00 *			0.00	· ¥		4,110	0.00
Terminal	вураѕѕ		0	U		0 -0.	.00 *			0.00	+		·	0.00
Grand To	tal==>	292,634	33,274	0	472,3	59 100.	.00 *	281	,206	100.00	-266	,799 -	381,080	100.00
,,					•				•				•	
				LING COIL S								ARE		
		Capacity	•	Coil Airfl		ring DB/			-	B/WB/HR	Gross T		Glass (st	(%)
	(Tons)		(Mbh)	(cfm)	_	Deg F G		Deg F		Grains	Floor	12,065		
Main Clg	39.4		478.2	46,440	74.7	58.0	56.8	63.8	54.1		Part	17,254		
Aux Clg	0.0		0.0	0	0.0	0.0	0.0	0.0	0.0		ExFlr	0		
Opt Vent	0.0		0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	4,235		0 0
Totals	39.4	472.4									Wall	8,132		0 0
	HEATI	NG COIL SELI	ECTION			AIRFLOWS	(cfm))		ENGINEERING	CHECKS	TEM	PERATURES	(F)
	Capaci	ty Coil A	irfl Ent	Lvg	Туре	Cooli	ng	Heating	Cl	g % OA	7.0	Тур	e Clg	Htg
	(Mbh			· ·	Vent	3,2	51	3,251	Cl	g Cfm/Sqft	3.85	SADB	65.7	78.0
Main Htg	-340	.6 46,4	440 70.3	78.0	Infil	3	23	323	Cl	g Cfm/Ton	1179.78	Plenu	m 73.0	70.5
Aux Htg	0.	.0	0.0	0.0	Supply	46,4	40	46,440	cl	g Sqft/Ton	306.51	Retur	n 73.0	70.7
Preheat	-0	.0 46,4		63.8	Mincfm		0	0		g Btuh/Sqft	39.15	Ret/0	A 74.7	67.4
Reheat	0.	.0	0.0	0.0	Return	46,4	40	46,440	No	. People	65	Runar	nd 72.0	
Humidif		.0	0 0.0	0.0	Exhaust	3,2		3,251		g % OA	7.0	Fn Mt	rTD 0.6	0.0
Opt Vent		.0	0 0.0	0.0	Rm Exh	-	0	0		g Cfm/SqFt	3.85	Fn Bl	dTD 0.5	0.0
Total	-340				Auxil		0	0		g Btuh/SqFt				
										•				

System	2	Block	DD	-	DOUBLE DUCT
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	at Time =		Mo/Hr:						lo/Hr:	.,		mu/	Hr: 13/ 1		
Outside	Air ==>	O	ADB/WB/HR:	97/ 64/ 49	.0		*	•	OADB:	97	*	OA	DB: 24		
		Space	Ret. Ai	r Ret. Air	N	et Percn	* *	,	Space	Percnt	* Snace	Peak	Cail Daak	_	
		Sens.+Lat.	Sensible			al Of To			sible	Of Tot	•	Sens	Coil Peak Tot Sens		ercr
Envelope		(Btuh)	(Btuh		(Btu				Btuh)			Btuh)	(Btuh)	U	f To
Skyli	te Solr	0		0	,	0 0.0			0	0.00	•	0	(6(41)		0.0
Skylii	te Cond	0	(0		0 0.00			0	0.00		0	0		0.0
Roof (Cond	0	12,709	9	12,70				0	0.00		0	-13,608		4.1
Glass	Solar	0	()	•	0 0.00	* (0	0.00		Ô	0		0.0
Glass	Cond	0	()		0.00) *		0	0.00		Ô	0		0.0
Wall (Cond	72,716	24,577	7	97,29	73 15.58	3 *	7	2,716	16.75		4,832	-167,314	5	50.8
Partit	ion	-5,411			-5,41	11 -0.87	*		5,411	-1.25		4,928	-64,928		19.7
Expose	d Floor	0			·	0.00	*		0	0.00		0	0		0.0
Infilt	ration	7,121			7,12	21 1.14	*	7	7, 8 85	1.82		4,848	-14,848		4.5
Sub To	tal==>	74,427	37,286	5	111,71	3 17.89	*		5,191	17.32		4,608	-260,698		9.2
Internal	Loads						*		•		*	.,		•	,
Lights	:	73,523	0)	73,52	3 11.77	*	73	5,523	16.93	*	0	0		0.0
People	•	19,740			19,74	0 3.16	*		,810	2.49	*	0	0		0.0
Misc		266,323	0	0	266,32	3 42.64	. *		, 3,323	61.34		0	0		0.0
Sub To	tal==>	359,585	0	0	359,58	5 57.57	*		,655	80.76		0	0		0.0
Ceiling	Load	4,319	-4,319)		0.00	*		459	0.80		5,209	0		0.0
Outside	Air	0 .	0	. 0	60,88	2 9.75	*		. 0	0.00		•	-126,942		8.5
Sup. Fan	Heat				90,49	5 14.49	*			0.00	*		90,495		7.5
Ret. Fan	Heat		0			0.00	*			0.00	*		0		0.0
Duct Hea	t Pkup		0			0.00	*			0.00	*		0		0.0
OV/UNDR	Sizing	4,876			4,87	6 0.78	*	4	,876	1.12	* -35	,774	-35,774		0.8
Exhaust	Heat		-2,988	0	-2,98	8 -0.48	*			0.00		•	3,851		1.1
Terminal	Bypass		0	0		0 -0.00	*			0.00	*		0		0.0
Grand To	tal==>	4/3 207	20 070	0	(2) 5(7 400 00	*				•				
ai ai iu i i o	ta(>	443,207	29,979	0	624,56	3 100.00	*	434	,181	100.00	-245	,591	-329,069	10	0.00
			coo	LING COIL S	ELECTION							AR	EAS		
		Capacity		Coil Airfl	Enter	ing DB/WB,	/HR	Lea	ving D	B/WB/HR	Gross T	otal	Glass (sf	f) ((%)
	(Tons)	(Mbh)	(Mbh)	(cfm)		eg F Gra	ins	Deg F	Deg F	Grains	Floor	12,065			
ain Clg	52.0	624.6	622.4	39,460	74.8	57.0 5	2.4	58.1	50.8	52.5	Part	15,624			
ux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	0			
ot Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	4,235		0	0
otals	52.0	624.6									Wall	7,884		0	0
	HEATIN	G COIL SELE	CTION		A	RFLOWS (d	fm)		(ENGINEERING	CHECKS	TF	1PERATURES	(F)	
	Capacit	y Coil Ai	rfl Ent	Lvg	Туре	Cooling		Heating		2 % OA	7.0				itg
	(Mbh)	(cfm	n) Deg F	Deg F	Vent	2,762		2,762		g Cfm/Sqft	3.27		60.5		78.5
in Htg	-420.	2 39,4	60 67.4	78.5	Infil	323		323		Cfm/Ton	758.16				70.4
ıx Htg	0.	0	0.0	0.0	Supply	39,460		39,460		Sqft/Ton	231.81				'O.5
eheat	-0.	0 39,4	60 67.3	58.1	Mincfm	0		. 0		Btuh/Sqft					7.3
heat	0.0		0.0	0.0	Return	39,460		39,460		People	47	•			2.0
midif	0.0		0.0	0.0	Exhaust	2,762		2,762		% OA	7.0	Fn Mt			0.0
t Vent	0.0		0.0	0.0	Rm Exh	0		. 0		Cfm/SqFt	3.27				0.0
tal	-420.2	2			Auxil							51			٠.٠

Block

DD

3

System

einteiniain

- DOUBLE DUCT

Mo/Hr: 13/ 1 Mo/Hr: 7/16 Peaked at Time ==> Mo/Hr: 7/16 OADB: 24 Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 OADB: 97 Coil Peak Space Percnt * Space Peak Percnt Ret. Air Ret. Air Net Percnt Space Space Sens Tot Sens Of Tot Of Tot Sensible Of Tot Sens.+Lat. Sensible Latent Total (%) (Btuh) (Btuh) Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) 0.00 * 0 Skylite Solr 0 0 0 0.00 0 0 0.00 Skylite Cond 0 0 0 0.00 0 0.00 * 0 0 0.00 Roof Cond 0 41,022 41,022 2.65 0 0.00 0 -43,963 5.50 n 14,028 0.91 40.581 4.51 0 0 0.00 Glass Solar 14,028 5,819 -16,967 Glass Cond 8,239 0 8,239 0.53 0.65 -16,967 2.12 Wall Cond 147,401 52,964 200,366 12.94 135,487 15.06 * -266,726 -361,665 45.23 -1.44 * -12,991 -12,991 -0.84 -12,991 -149,871 -149,871 18.74 Partition 0.00 * O 0.00 0 0.00 0 Exposed Floor 0 2.57 * -45,361 -45,361 5.67 Infiltration 20,007 20,007 1.29 23,124 Sub Total==> 176,683 93,986 270,670 17.48 * 192,019 21.34 -478,926 -617,828 77.27 Internal Loads 26.52 * 0 0.00 0 238,645 15.41 238,645 Lights 238,645 3.94 * 0.00 64,680 64,680 4.18 35,420 n n People Misc 425,318 425,318 27.47 425,318 47.27 * 3,208 3,208 -0.4077.72 3,208 3,208 -0.40 Sub Total ==> 728,643 0 728,643 47.06 699,382 7,258 0.81 * -11,689 0.00 7,657 -7,657 0 0.00 Ceiling Load -430,464 53.84 189,859 0.00 * Outside Air . 0 ... 0 12.26 0 0.00 363,958 -45.52 Sup. Fan Heat 363,958 23.51 0 0 0.00 0.00 0 0.00 Ret. Fan Heat 0 0.00 0.00 0 0.00 Duct Heat Pkup 0 0.13 -127,578 1,182 1,182 0.08 1,182 -127,578 15.96 OV/UNDR Sizing -5,903 -0.38 0.00 9,137 -1.14 -5.903 0 Exhaust Heat -0.00 0.00 0.00 0 Terminal Bypass n Grand Total==> 914,165 80,427 1,548,408 100.00 * 899,842 100.00 * -614,985 -799,567 100.00 ------COOLING COIL SELECTION----------AREAS-----Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR **Gross Total** Glass (sf) (%) Total Capacity (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 36,710 129.0 133,808 74.4 57.5 53.0 55.3 41,631 Main Clg 1,548.4 1,560.1 55.1 62.1 Part Aux Clg 0 0.0 0.0 0.0 0.0 0.0 0.0 Exflr 0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0 0 0.0 0.0 0.0 0 0.0 0.0 13,521 Opt Vent Roof 129.0 1,548.4 Wall 17,879 501 Totals ------HEATING COIL SELECTION-----------AIRFLOWS (cfm)-------- ENGINEERING CHECKS ---- TEMPERATURES (F)---Capacity Cooling Cla % OA 7.0 Clg Kta Coil Airfl Ent Lvg Type Heating Type 9,366 Clg Cfm/Sqft 3.64 65.0 (Mbh) (cfm) Deg F Deg F Vent 9,366 SADB 76.8 Main Htg -1,219.0 133,808 67.3 76.8 Infil 987 987 Clg Cfm/Ton 1037.00 Plenum 72.7 70.9 Aux Htg 0.0 0 0.0 0.0 Supply 133,808 133,808 Clg Sqft/Ton 284.50 Return 72.7 71.0 Preheat -0.0 133,808 67.7 62.1 Mincfm 0 0 Clg Btuh/Sqft 42.18 Ret/OA 74.4 67.7 133.808 133,808 154 Reheat 0.0 0 0.0 0.0 Return No. People Runarnd 72.0 72.0 9,366 **Humidif** -439.3 10.353 4.7 75.1 Exhaust 9,366 Htg % OA 7.0 Fn MtrTD 0.9 0.0 Opt Vent 0.0 0.0 0.0 Rm Exh 0 0 Htg Cfm/SqFt 3.64 Fn BldTD 0.7 0.0 Total -1,658.3 **Auxil** Htg Btuh/SqFt -33.21 Fn Frict

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 300

					Ro	om U-Va	ılues				Room	Room
					(Bt	:u/hr/sc	ft/F)				Mass	Capac.
Room	1			Summr	Wintr	•	Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	Z1-BSMT EAST	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
Zone	1 Total/Ave.	. 0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
2	Z1-1ST FLR EAST	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
Zone	2 Total/Ave.	. 0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
3	Z2-1ST FLR EAST	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
Zone	3 Total/Ave.	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
4	Z1-2ND FLR EAST	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456		142.8	28.70
Zone	4 Total/Ave.	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456		142.8	28.70
5	Z2-2ND FLR EAST	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438		132.4	26.83
Zone	5 Total/Ave.	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438		132.4	26.83
System	1 Total/Ave.	0.393	0.000	0.000	0.000	0.070	0.000	0.000	0.448		148.3	29.43
6	Z1-BSMT WEST	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
Zone	6 Total/Ave.	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
7.	Z2-BSMT WEST	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
Zone	7 Total/Ave.	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	
8	Z1-1ST FLR WEST	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
Zone	8 Total/Ave.	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
9	Z2-1ST FLR WEST	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
Zone	9 Total/Ave.	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
10	Z1-2ND FLR WEST	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
Zone	10 Total/Ave.	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
11	Z2-2ND FLR WEST	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
Zone	11 Total/Ave.	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
System	2 Total/Ave.	0.472	0.000	0.000	0.000	0.070	0.000	0.000	0.446	0.317	152.2	30.37
12	Z3-BSMT SOUTH	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
Zone	12 Total/Ave.	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
13	Z2-BSMT SOUTH	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
Zone	13 Total/Ave.	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
14	Z1-BSMT SOUTH	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
Zone	14 Total/Ave.	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
15	Z1-1ST FLR SOUTH	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
Zone	15 Total/Ave.	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
16	Z2-1ST FLR SOUTH	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
Zone	16 Total/Ave.	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
17	Z3-1ST FLR SOUTH	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
Zone	17 Total/Ave.	0.130	0.000		0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
18	Z3-2ND FLR SOUTH			0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
Zone	18 Total/Ave.	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
19	Z1-2ND FLR SOUTH		0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
Zone	19 Total/Ave.	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
20	Z2-2ND FLR SOUTH	0.151		0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
Zone	20 Total/Ave.	0.151		0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
System	3 Total/Ave.			0.000	0.000	0.070	0.653	0.706	0.437	0.317	129.1	25.81
Building				0.000	0.000	0.070				0.317	137.5	
•							0.000	0.100	U.442	0.311	131.3	27.43

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BUILDING AREAS - ALTERNATIVE 1 BASELINE BUILDING 300

------BUILDING AREAS ------

				Floor	Total		Exposed						
		Numbe	er of	Area/Dupl	Floor	Partition	Floor	Skylight	skl	Net Roof	Window	Win	Net Wall
Room		Dupli	icate	Room	Area	Area	Area	Area	/Rf	Area	Area	/Wl	Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	Z1-BSAST 1	1		3,595	3,595	8,458	0	0 0		0	0 0		247
Zone	1 Total/Ave.				3,595	8,458	0	0	0	0	0	0	247
2	Z1-1ST FLR EAST	1	1	1,595	1,595	2,145	0	0	0	0	0	0	1,368
Zone	2 Total/Ave.				1,595	2,145	0	0	0	0	0	0	1,368
3	Z2-1ST FLR EAST	1	1	2,640	2,640	858	0	0	0	0	0	0	2,574
Zone	3 Total/Ave.				2,640	8 58	0	0	0	0	0	0	2,574
4	Z1-2ND FLR EAST	1	1	1,595	1,595	3,045	0	0	0	1,595	0	0	1,368
Zone	4 Total/Ave.				1,595	3,045	0	0	0	1,595	0	0	1,368
5	Z2-2ND FLR EAST	1	1	2,640	2,640	2,748	0	0	0	2,640	0	0	2,574
Zone	5 Total/Ave.				2,640	2,748	0	0	0	2,640	0	0	2,574
System	1 Total/Ave.				12,065	17,254	0	0	0	4,235	0	0	8,132
6	Z1-BSMT WEST	1	1	3,280	3,280	5,763	0	0	0	0	0	0	0
Zone	6 Total/Ave.				3,280	5,763	0	0	0	0	0	0	0
7	Z2-BSMT WEST	1	1	315	315	909	0	0	0	0	0	0	0
Zone	7 Total/Ave.				315	909	0	0	0	0	0	0	0
8	Z1-1ST FLR WEST	1	1	1,595	1,595	2,784	0	0	0	0	0	0	1,368
Zone	8 Total/Ave.				1,595	2,784	0	0	0	0	0	0	1,368
9	Z2-1ST FLR WEST	1	1	2,640	2,640	1,080	0	0	0	0	0	0	2,574
Zone	9 Total/Ave.				2,640	1,080	0	0	0	0	0	0	2,574
10	Z1-2ND FLR WEST	1	1	1,595	1,595	2,565	0	0	0	1,595	0	0	1,368
Zone	10 Total/Ave.	_			1,595	2,565	0	0	0	1,595	0	0	1,368
	Z2-2ND FLR WEST	1	1	2,640	2,640	2,523	0	0	0	2,640	0	0	2,574
Zone	11 Total/Ave.				2,640	2,523	0	0	0	2,640	0	0	2,574
System	2 Total/Ave.	_			12,065	15,624	0	0	0	4,235	0	0	7,884
_	Z3-BSMT SOUTH	1	1	2,202	2,202	6,539	0	0	0	0	0	0	0
Zone	12 Total/Ave.			7 700	2,202	6,539	0	0	0	0	0	0	0
	ZZ-BSMT SOUTH	1	1	3,780	3,780	9,473	0	0	0	0	0	0	0
Zone	13 Total/Ave. Z1-BSMT SOUTH	1	1	7 405	3,780	9,473	0	0	0	0	0	0	0
Zone	14 Total/Ave.		1	3,685	3, 685	8,091 8,001	0 0	0	0	0	0	0	49 49
	Z1-1ST FLR SOUTH	1	1	4,089	3,685 4,089	8,091 6,168	0	Ü		0	0 0	_	2,628
Zone	15 Total/Ave.	•	•	4,007	4,089	6,168	0	0	0	0	0	,	2,628
	Z2-1ST FLR SOUTH	1	1	6,002	6,002	2,415	0	0	0	0	501	14	3,171
Zone	16 Total/Ave.	•	•	0,002	6,002	2,415	0	0	0	0	501	14	3,171
	Z3-1ST FLR SOUTH	1	1	3,430	3,430	2,352	0	0	0	0	0	0	2,475
Zone	17 Total/Ave.	•	•	5,450	3,430	2,352	0	Ö	Õ	0	0	0	2,475
	Z3-2ND FLR SOUTH	1	1	5,763	5,763	3,444	0	0	ō	5,763	0	0	3,348
Zone	18 Total/Ave.	•	-	- 1.00	5,763	3,444	0	0	ō	5,763	0	0	3,348
	Z1-2ND FLR SOUTH	1	1	2,077	2,077	930	0	0	0	2,077	0	0	2,313
Zone	19 Total/Ave.	•	-	-,	2,077	930	0	0	o	2,077	0	0	2,313
	Z2-2ND FLR SOUTH	1	1	5,681	5,681	2,220	0	0	0	5,681	0	0	3,393
Zone	20 Total/Ave.			•	5,681	2,220	0	0	0	5,681	0	0	3,393
System	3 Total/Ave.				36,710	41,631	0	0	0	13,521	501	3	17,378
Building					60,840	74,509	0	0	0	21,991	501	1	33,393
						-				-			•

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1
BASELINE BUILDING 300

System Totals

Percent	Cool	ing Loa	d	Heati	ng Load		Cooling	Airflo	,	Heating	Airflo	,
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.		Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	11.0	0	0	-120,956	22	946	10,985.4	0	0	0.0	0	0
5 - 10	22.0	0	0	-241,912	19	817	21,970.8	0	0	0.0	0	0
10 - 15	33.1	0	0	-362,869	15	659	32,956.2	0	0	0.0	0	0
15 - 20	44.1	10	872	-483,825	12	519	43,941.6	0	0	0.0	0	0
20 - 25	55.1	17	1,491	-604,781	13	556	54,927.0	0	0	0.0	0	0
25 - 30	66.1	12	1,025	-725,737	8	364	65,912.4	0	0	0.0	0	0
30 - 35	77.2	7	624	-846,693	6	238	76,897.8	0	0	0.0	0	0
35 - 40	88.2	9	801	-967,650	5	218	87,883.2	0	0	0.0	0	0
40 - 45	99.2	5	448	-1,088,606	0	0	98,868.6	0	0	0.0	0	0
45 - 50	110.2	8	730	-1,209,562	0	0	109,854.0	0	0	0.0	0	0
50 - 55	121.2	7	593	-1,330,518	0	0	120,839.4	0	0	0.0	0	0
55 - 60	132.3	5	427	-1,451,474	0	0	131,824.8	0	0	0.0	0	0
60 - 65	143.3	5	438	-1,572,431	0	0	142,810.2	0	0	0.0	0	0
65 - 70	154.3	5	432	-1,693,387	0	0	153,795.6	0	0	0.0	0	0
70 - 75	165.3	3	235	-1,814,343	0	0	164,781.0	0	0	0.0	0	0
75 - 80	176.4	2	212	-1,935,299	0	0	175,766.4	0	0	0.0	0	0
80 - 85	187.4	2	154	-2,056,255	0	0	186,751.8	0	0	0.0	0	0
85 - 90	198.4	2	150	-2,177,211	0	0	197,737.2	0	0	0.0	0	0
90 - 95	209.4	1	108	-2,298,168	0	0	208,722.6	0	0	0.0	0	0
95 - 100	220.4	0	20	-2,419,124	0	0	219,708.0	100	8,760	0.0	0	0
Hours Off	0.0	0	0	0	0	4,443	0.0	0	0	0.0	0	8.760

	М	0	N	T	Н	L	Y	Ε	N	Ε	R	G	Y	C	0	N	S	U	M	P	T	I	0	N	
--	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	--

	ELEC	DEMAND	GAS		GAS DMND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(k\h)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)
Jan	370,311	664	6,458	145	14
Feb	335,056	663	5,227	135	14
March	378,559	692	2,512	182	8
April	374,522	726	585	227	3
May	406,945	754	9	326	0
June	414,722	831	0	382	0
July	433,778	837	0	408	0
Aug	434,746	829	0	398	0
Sept	398,870	7 57	0	321	0
0ct	394,963	729	782	248	4
Nov	362,831	690	2,815	175	9
Dec	370,472	668	5,163	156	11
Total	4,675,776	837	23,551	3,104	14

Building Energy Consumption ≈ Source Energy Consumption ≈ 301,008 (Btu/Sq Ft/Year) 302,206 (Btu/Sq Ft/Year) Floor Area = 60,840 (Sq Ft)

Zmmthly Kw= 8840

D8-14

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------UTILITY PEAK CHECKSUMS-----

Utility ELECTRIC DEMAND

Peak Value 837.1 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp.			Utility	
Ref.	Equipment		Demand	Of Tot
Num.	Code Name	Equipment Description	(kW)	(%)
Cooling	Equipment			
1	EQ1001S	2-STG CTV <555 TONS	179.4	21.43
2	EQ1122L	AIR-CLD RECIP >55 TONS	111.0	13.27
Sub Tota	ι		290.4	34.69
Sub Tota	ι		0.0	0.00
'Air''Movi	ng Equipment			
1		SUMMATION OF FAN ELECTRICAL DEMAND	48.5	5.79
2		SUMMATION OF FAN ELECTRICAL DEMAND	33.6	4.01
3		SUMMATION OF FAN ELECTRICAL DEMAND	119.4	14.26
Sub Tota	ι		201.4	24.06
Sub Total	ι		0.0	0.00
Miscellar	neous			
Lights			109.1	13.04
Base Uti	iliti e s		0.0	0.00
Misc Equ	uipment		236.2	28.21
Sub Total	l		345.3	41.25
Grand Tot	tal		837.1	100.00

ESOS STUDY AT WSMR - BUILDING 300
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
RANGE CONTROL BLDG: ALT 1-BSLN, ALT2-ECO (ENERGY EFFICIENT LIGHTING)

Weather File Code:	ELPASO).W
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Hinton Claannaga Numbers	4 00	

Summer Clearness Number:	1.00
Winter Clearness Number:	1.00
Summer Design Dry Bulb:	98 (F)
Summer Design Wet Bulb:	64 (F)
Winter Design Dry Bulb:	24 (F)
Summer Ground Relectance: ·	0.20
Winter Ground Relectance:	0.20

All Delisity:	0.0000	(LDM/CUTT)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 6:55:35 6/23/92

Dataset Name: 300 .TM

100

System 1 Block DD - DOUBLE DUCT

*****	*****	***** C(OOLING COIL	PEAK *****	*****	*****	****	**** CLG	SPACE	PEAK *****	***** HEAT	ING COIL P	EAK *1	****	**
	Time ==>		Mo/Hr:				*	Mo/	/Hr: 7	7/16 *		Mo/Hr: 13	/ 1		,
Outside A	ir ==>	OAI	OB/WB/HR:	97/ 64/ 49.0)		*	O#	ADB: S	97 *		OADB: 2	4		
		Coooo	Dot Ain	Ret. Air	N.	et Per	cnt *	Sr	oace	Percnt *	Space Pea	k Coil P	eak	Perc	nt
	0-	Space	Sensible		Tota		Tot *	Sensi		Of Tot *	Space Sen	s Tot S	ens	Of 1	ot
		ns.+Lat.	(Btuh)		(Btul		(%) *		tuh)	(%) *	(Btuh) (Bt	uh)	(%)
Envelope		(Btuh)	(Bluit)		(500		.00 *	•••	0	0.00 *		0	0	0.	.00
Skylite		0	0				.00 *		0	0.00 *		0	0	0.	.00
Skylite		0			12,7		.76 *		Ō	0.00 *		0 -13,	550	3.	56
Roof Co		0	12,734 0		16,1.		.00 *		0	0.00 *		0	0	0.	.00
Glass S		0	0				.00 *		Ō	0.00 *		0	0	0.	.00
Glass C		0 476	•		108,9		.64 *	81.	,117	30.04 *	-128,96	9 -173,	237	45.	46
Wall Co		81,136	27,781		-4,9		.08 *		965	-1.84 *	-60,13			15.	78
Partiti		-4,965			-4,7		.00 *		0	0.00 *	•	0	0	0.	.00
Exposed		0			. 41		.33 *	7	,886	2.92 *	-14,84	8 -14,	848		.90
Infiltr		6,151			6,1					31.12 *	-203,95			68.	
Sub Tot	:al==>	82,321	40,515		122,8	36 20	.66 *	04,	,038	31.12 ···	-203,73		•••	-	
Internal	Loads					40	· ·	40	920	18.08 *		0	0	n	.00
Lights		48,829	0		48,8		.60 *		,829			0	0		.00
People		27,300			27,3		.92 *		,950	5.54 *		0	0		.00
Misc		103,877	0	_	103,8		.54 *		,877	38.47 *		0	0		.00
Sub Tot	al==>	180,006	0		180,0		.07 *		,656	62.09 *	-4,62	-	o		.00
Ceiling L	.oad	3,991	-3,991				.00 *	3	,230	1.20 * 0.00 *	-	.0 -149,	-	39.	
Outside A	ir	0	0	0	61,8		.43 *		0			84,		-22	
Sup. Fan	Heat				84,2		.28 *			0.00 * 0.00 *		04,	0		.00
Ret. Fan	Heat		0				.00 *						o		.00
Duct Heat	: Pkup		0				.00 *	45	007	0.00 *	-58,22	20 -58,	-		.28
OV/UNDR S	izing	15,084			15,0		.27 *	15,	,084	5.59 *	-30,22	•	116		.08
Exhaust H	leat		-3,250		-3,2		.71 *			0.00 *		٠,	0		.00
Terminal	Bypass		0	0		0 -0	.00 *			0.00 *			·	•	.00
				_			*	270	000	100.00 *	-266,79	× -381,	กรก	100	nn
Grand Tot	al==>	281,402	33,274	0	460,7	81 100	- 00	270	,008	100.00	-200,13	301,	000		
				LING COIL S								AREAS			
	Total C	apacity	Sens Cap.	Coil Airfl		ring DB				B/WB/HR	Gross Tota		s (sf	, (•)
	(Tons)	(Mbh)	(Mbh)	(cfm)		Deg F				Grains		12,065			
Main Clg	38.4	460.8	467.0	46,440	74.7	58.0	57.0	64.0	54.3	57.5		17,254			
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0		Exflr	0		_	•
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	4,235		0	0
Totals	38.4	460.8									Wall	8,132		0	0
	HEATING	COIL SEL	ECTION			AIRFLOW	S (cfm))	1	ENGINEERING	CHECKS	TEMPERA	TURES	(F)	
	Capacity			Lvg	Type	Cool	ing	Heating	Cl	g % OA	7.0	Type	Clg		tg
	(Mbh)	(cf	m) Deg F	Deg F	Vent	3,	251	3,251	Cl	g Cfm/Sqft	3.85	SADB	65.9		B.0
Main Htg	-340.6	46,	440 70.3		Infil		323	323	Cl	g Cfm/Ton	1209.43	Plenum	73.0		0.5
Aux Htg	0.0)	0 0.0	0.0	Supply	46,	440	46,440	Cl	g Sqft/Ton	314.21	Return	73.0		0.7
Preheat	-0.0				Mincfm		0	0	Cl	g Btuh/Sqft	38.19	Ret/OA	74.7	6	7.4
Reheat	0.0	-	0 0.0		Return	46,	440	46,440	No	. People	65	Runarnd	72.0		2.0
Humidif	0.0		0 0.0		Exhaust	3,	251	3,251	Ht	g % OA	7.0	Fn MtrTD	0.6		0.0
Opt Vent	0.0		0 0.0		Rm Exh		0	0	Ht	g Cfm/SqFt	3.85	Fn BldTD	0.5		0.0
Total	-340.6				Auxil		0	0	Ht	g Btuh/SqFt	-28.23	Fn Frict	1.4	. 1	0.0

System 2 Block DD - DOUBLE DUCT

*****	******	******	COOLING COI	PEAK ****	*****	*****	****	*** CLG	SPACE	PEAK ****	****** H	EATING COIL	PEAK 1	*****
	at Time ==		Mo/Hr:				*			7/16	t .	Mo/Hr:		
Outside	Air ==>	O.	ADB/WB/HR:	97/ 64/ 49.	.0		*	0	ADB:	97	*	OADB:	24	
							*			•	*			
		Space	Ret. Ai	Ret. Air	Net	Percnt	*	S	pace	Percnt	Space	Peak Coil	Peak	Percnt
	\$	Gens.+Lat.	Sensible	e Latent	Total	Of Tot	*	Sens	ible	Of Tot	* Space	Sens Tot	Sens	Of Tot
Envelope	e Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(B	tuh)	(%)	* (B	tuh) (1	Stuh)	(%)
Skylit	te Solr	0	()	C	0.00	*		0	0.00	t .	0	0	0.00
Skylit	te Cond	0	()	C	0.00	*		0	0.00	•	0	0	0.00
Roof (Cond	0	12,709)	12,709	2.04	*		0	0.00	t	0 -13	,608	4.14
Glass	Solar	0	()	0	0.00	*		0	0.00	•	0	0	0.00
Glass	Cond	0	()	0	0.00	*		0	0.00	•	0	0	0.00
Wall (Cond	72,716	24,577	,	97,293	15.58	*	72	,716	16.75	-124	,832 -167	,314	50.84
Partii	tion	-5,411			-5,411	-0.87	*	-5	,411	-1.25	-64	,9 28 -64	,928	19.73
Expose	ed Floor	0			0	0.00	*		0	0.00	*	0	0	0.00
Infilt	tration	7,104			7,104	1.14	*	7	,885	1.82	-14,	,848 -14	,848	4.51
Sub To	otal==>	74,410	37,286	•	111,695	17.89	*	75	,191	17.32	-204	,608 -260	,698	79.22
Internal	Loads						*			1	•			
Lights	5	59,476	0)	59,476	9.53	*	59	,476	13.70	•	0	0	0.00
People	•	19,740			19,740	3.16	*	10	,810	2.49	•	0	0	0.00
Misc		266,323	0	0	266,323	42.65	*	266	,323	61.34	t	0	0	0.00
Sub To	otal==>	345,538	0	0	345,538	55.34	*	336	,608	77.53	•	0	0	0.00
Ceiling	Load	4,319	-4,319	•	0	0.00	*	3,	,459	0.80	-5,	,209	0	0.00
Outside	Air	0	0	. 0	60,736	9.73	*		0	0.00	•	0 -126	,942	38.58
Sup. Fan	Heat				90,495	14.49	*			0.00	•	90	,495	-27.50
Ret. Fan	n Heat		0		0	0.00	*			0.00	•		0	0.00
Duct Hea	at Pkup		0		0	0.00	*			0.00	•		0	0.00
OV/UNDR	Sizing	18,910			18,910	3.03	*	18,	,910	4.36	-35,	,774 -35	,774	10.87
Exhaust	Keat		-2,988	0	-2,988	-0.48	*			0.00	•	3	,851	-1.17
Terminal	Bypass		0	0	0	-0.00	*			0.00	•		0	0.00
Grand To	tal==>	443,177	29,979	0	624,388	100.00	*	434	,168	100.00	-245,	591 -329	,069	100.00
				LING COIL S	FI FCT ION							AREAS-		
	Total	Capacity		Coil Airfl		ng DB/WB/	HR	Leav	ing Di	3/WB/HR	Gross To		ss (sf) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F Deg	g F Grai	ns	Deg F	Deg F	Grains	Floor	12,065	-	
Main Clg	52.0	624.4	622.4	39,460	74.8 5	7.0 52	.5	58.1	50.8	52.6	Part	15,624		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	.0	0.0	0.0	0.0	ExFlr	0		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	.0	0.0	0.0	0.0	Roof	4,235		0 0
Totals	52.0	624.4									Wali	7,884		0 0
	HEATING	COIL SELI	ECTION		AIF	RFLOWS (c	fm)		E	NGINEERING	CHECKS	TEMPER	ATURES	(F)
	Capacity			Lvg	Туре	Cooling		eating		% OA	7.0	Туре	Clg	Htg
	(Mbh)	(cfi	n) Deg F	Deg F	Vent	2,762		2,762		Cfm/Sqft	3.27	SADB	60.5	78.5
Main Htg	-420.2	2 39,4	460 67.4	78.5	Infil	323		323	-	Cfm/Ton	758.37	Plenum	73.1	70.4
Aux Htg	0.0)	0 0.0	0.0	Supply	39,460		39,460		Sqft/Ton	231.88	Return	73.1	70.5
Preheat	-0.0	39,4		58.1	Mincfm	0		0		Btuh/Sqft		Ret/OA	74.8	
Reheat	0.0	·	0.0	0.0	Return	39,460		39,460		People	47	Runarnd	72.0	72.0
Humidif	0.0)	0.0	0.0	Exhaust	2,762		2,762		% OA	7.0	Fn MtrTD	0.8	0.0
Opt Vent	0.0)	0.0	0.0	Rm Exh	. 0		0		Cfm/SqFt	3.27	Fn BldTD	0.6	0.0
Total	-420.2	2			Auxil	0		0		Btuh/SqFt		Fn Frict	1.8	

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System 3 Block DD - DOUBLE DUCT

	: 13/ 1	-		-	/16	ir: 7	HO)	-			/16	Hr: 7	Moz		: Time ==>	Peaked at
	: 24	OADB:		*	7	B: 9	OA.	*			7/ 64/ 49.0			OAI		Outside A
Perc	il Peak	eak Coi	Space Pe	*	Percnt	ace	Sn	* * nt	: Per	N	Dot Ain	4:-	5-4			
Of T	ot Sens	ens To	Space Se	*	Of Tot		Sensi		_	Tot	Ret. Air Latent	. Air sible		Space	Car	
C	(Btuh)	uh)	(Btu	*	(%)	_	(Bt	(%) *		(Btu	(Btuh)	Btuh)		ns.+Lat.	_	
0.	0	0		*	0.00	0	,	.00 *		(500	(BCGII)	0	,	(Btuh) O		nvelope
0.	0	0		*	0.00	0		.00 *				0		0		Skylite
5.	-43,963	0 -		*	0.00	0		.65 *		41,0		1,022	,	0		Skylite
0.	0	0		*	4.52	581	40,	.91 *		14,0		0	•	14,028		Roof Co
2.	-16,967	967 -	-16,9	*	0.65	319	-	.53 *		8,2		0		8,239		Glass C
45.	361 ,6 65	726 -3	-266,7	*	15.08		135,	.95 *		200,3		2,964		<u></u>		-
18.	149,871	871 -1	-149,8	*	-1.45		-12,	.84 *		-12,9		2,704	•	147,401		Wall Co
0.	0	0			0.00	0	•	.00 *		1277				-12,991 0		Partiti
5.	-45,361	361 ·	-45,3		2.57	124	23,	.29 *		19,9						Exposed
77.	617,828		-478,9		21.37		192,	.50 *		270,6		7 00/		19,989		Infiltr
	•			*	2.13.	,	.,,,		. "	210,0		3,986	,	176,665		Sub Tot
0.	0	0		*	21.50	225	107	/O *	. 42	407.2					Loads	nternal
0.	0	0		*	3.94		193,	.49 *		193,2		0		193,225		Lights
-0.	3,208	-	3,2				35,	.18 *		64,6				64,680		People
-0.	3,208	208 208	=		47.33		425,	.49 *		425,3	0	0		425,318		Misc
0.	3,200		•	*	72.78		653,	.17 *		683,2	0	0		683,223	:al==>	Sub Tot
53.	430,464		-11,6	*		258	ζ,	.00 *				7,657	•	7,657	.oad	eiling L
-45.	363,958			*		0		.26 *		189,6	0	0		0	ir	tside A
0.	0	•						.53 *		363,9					Heat	p. Fan
0.	0				0.00			.00 *				0			Heat	t. Fan
15.	127,578	578 -	-127,5		0.00	757	15	* 00.				0			: Pkup	ıct Heat
-1.	9,137	310	- 121,2		5.05	333	45,	.93 *		45,3				45,353	izing	/UNDR S
0.	9,131			*	0.00 0.00			.38 *		-5,9	0	5,903	•		leat	khaust H
٠.	•			*	0.00			.00 *) -0		0	0			Bypass	rminal
100.	799,567	085 -	-614,9		100.00	E07	900	-	. 400	4 544 6	_					
	.,,,,,,	,0,5	-014,7		100.00	293	8 98,	.00 -	7 100	1,546,9	0	0,427	•	912,898	:al==>	rand Tot
		ARE								LECTION-	ING COIL SE	cool				
sf) (%	Glass (s		Gross Tot		/WB/HR	ing DB	Leav	/WB/HR	ing DB	Ente	Coil Airfl	Cap.	Sens	apacity	Total C	
		36,710	Floor		Grains	Deg F	Deg F	Grains	eg F	Deg F	(cfm)	h)	(MI	(Mbh)	(Tons)	
		41,631	Part		55.3	53.0	62.1	55.1	57.5	74.4	133,808	8.8	1,5	1,547.0	128.9	in Clg
		0	ExFlr		0.0	0.0	0.0	0.0	0.0	0.0	0	0.0		0.0	0.0	x Clg
0		13,521	Roof		0.0	0.0	0.0	0.0	0.0	0.0	0	0.0		0.0	0.0	t Vent
501		17,879	Wall											1,547.0	128.9	tals
ES (F)-	IPERATURE	TEM	CHECKS	NG	NGINEERI	F		s (cfm)	ibei (K.			1	FATIO			
		Тур	7.0		% OA		Heating		Cool					COIL SEL		
	65.	SADB	3.64	+	Cfm/Sqf	-	9,366	1119 366		Type	Lvg	Ent			Capacity	
		Plenu	1037.96		Cfm/Ton	_	987	987	-	Vent	-	Deg F		(cf	(Mbh)	
		Retur	284.76		Sqft/To	_				Infil		67.3		_	-1,219.0	in Htg
		Ret/O			Btuh/Sq	-	133,808		133,	Supply		0.0	0		0.0	x Htg
		Runari	154	,, ,		_	477 000	0	477	Mincfm		67.7			-0.0	eheat
		Fn Mt	7.0		People		133,808		133,	Return	0.0	0.0	0		0.0	heat
_		Fn Blo			% OA		9,366	366	9,	Exhaust		4.7	353	_	-439.3	midif
	_		3.64		Cfm/SqF	_	0	0		Rm Exh		0.0	0		0.0	t Vent
	rict 2.	fn Fr	-33.21	ĮΓť	Btuh/Sq	Htg	G	0		Auxil					-1,658.3	tal

BUILDING U-VALUES - ALTERNATIVE 2
ECO - EFFICIENT LIGHTING - BUILDING 300

------ BUILDING U-VALUES -----

		Room U-Values							Room	Room		
					(Bti	ı/hr/sqt	ft/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	Z1-BSMT EAST	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
Zone	1 Total/Ave.	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
2	Z1-1ST FLR EAST	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
Zone	2 Total/Ave.	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
3	Z2-1ST FLR EAST	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
Zone	3 Total/Ave.	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
4	Z1-2ND FLR EAST	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
Zone	4 Total/Ave.	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
5	Z2-2ND FLR EAST	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
Zone	5 Total/Ave.	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
System	1 Total/Ave.	0.393	0.000	0.000	0.000	0.070	0.000	0.000	0.448	0.317	148.3	29.43
. 6	Z1-BSMT WEST	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
Zone	6 Total/Ave.	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
7	Z2-BSMT WEST	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
Zone	7 Total/Ave.	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
8	Z1-1ST FLR WEST	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
Zone	8 Total/Ave.	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
9	Z2-1ST FLR WEST	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
Zone	9 Total/Ave.	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
10	Z1-2ND FLR WEST	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
Zone	10 Total/Ave.	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
11	Z2-2ND FLR WEST	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
Zone	11 Total/Ave.	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
System	2 Total/Ave.	0.472	0.000	0.000	0.000	0.070	0.000	0.000	0.446	0.317	152.2	30.37
12	Z3-BSMT SOUTH	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
Zone	12 Total/Ave.	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
13	Z2-BSMT SOUTH	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
Zone	13 Total/Ave.	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
14	Z1-BSMT SOUTH	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
Zone	14 Total/Ave.	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
15	Z1-1ST FLR SOUTH	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
Zone	15 Total/Ave.	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
16	Z2-1ST FLR SOUTH	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
Zone	16 Total/Ave.	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
17	Z3-1ST FLR SOUTH	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
Zone	17 Total/Ave.	0.130		0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
	Z3-2ND FLR SOUTH	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
Zone	18 Total/Ave.	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
19	Z1-2ND FLR SOUTH	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
Zone	19 Total/Ave.	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
	Z2-2ND FLR SOUTH	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
Zone	20 Total/Ave.	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
System	3 Total/Ave.	0.417	0.000	0.000	0.000	0.070	0.653	0.706	0.437		129.1	25.81
Buildin	· ·		0.000			0.070		0.706			137.5	27.43
buitain	9	0.423	0.000	0.000	0.000	0.070	0.000	0.700	0.442	0.317	131.3	21.43

BUILDING AREAS - ALTERNATIVE 2 ECO - EFFICIENT LIGHTING - BUILDING 300

BUILDING AREAS -----

				Floor	Total		Exposed	Claul šabė	Skl	Net Roof	Window	Win	Net Wall
				Area/Dupl	Floor	Partition	Floor	Skylight	/Rf	Area	Area	/ul	Area
Room		•	icate	Room	Area	Area	Area	Area (sqft)	/K1 (%)	(sqft)	(sqft)	(%)	(sqft)
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqrt)	(^)	(sq. c)	(aqı c)	(,,,,	(04,1)
	74 DOUT FACT	1	1	3,595	3,595	8,458	0	0	0	0	0	0	247
1	Z1-BSMT EAST	•	•	3,373	3,595	8,458	0	0	0	0	0	0	247
Zone	1 Total/Ave. Z1-1ST FLR EAST	1	1	1,595	1,595	2,145	0	0	0	0	0	0	1,368
_ 2		•	'	1,373	1,595	2,145	0	0	0	O	0	0	1,368
Zone	2 Total/Ave.	1	1	2,640	2,640	858	0	0	0	0	0	0	2,574
3	Z2-1ST FLR EAST	'	•	2,040	2,640	8 58	0	0	0	0	0	0	2,574
Zone	3 Total/Ave.		1	1,595	1,595	3,045	0	0	0	1,595	0	0	1,368
	Z1-2ND FLR EAST	1	•	1,373	1,595	3,045	0	0	0	1,595	0	0	1,368
Zone	4 Total/Ave.			2,640	2,640	2,748	0	0	0	2,640	0	0	2,574
	Z2-2ND FLR EAST	1	1	2,640	2,640	2,748	0	0	0	2,640	0	0	2,574
Zone	5 Total/Ave.				12,065	17,254	0	0	Ō	4,235	0	0	8,132
System	1 Total/Ave.			7 280	3,280	5,763	0	0	Ö	0	0	0	0
- 6	Z1-BSMT WEST	1	1	3,280	3,280	5,763	0	0	Ō	0	0	0	0
Zone _	6 Total/Ave.			315	315	909	0	0	0	0	0	0	0
7	Z2-BSMT WEST	1	1	312	315	909	0	0	Ō	0	0	0	. 0
Zone	7 Total/Ave.	4	1	1,595	1,595	2,784	0	0	0	0	0	0	1,368
8	Z1-1ST FLR WEST	1	'	1,373	1,595	2,784	0	0	0	0	0	0	1,368
Zone	8 Total/Ave.		1	2,640	2,640	1,080	0	0	0	0	0	0	2,574
9	Z2-1ST FLR WEST	1	ŀ	2,640	2,640	1,080	0	0	0	0	0	0	2,574
Zone	9 Total/Ave.		4	1 505	1,595	2,565	0	0	O	1,595	0	0	1,368
	Z1-2ND FLR WEST	1	1	1,595	1,595	2,565	0	0	0	1,595	0	0	1,368
Zone	10 Total/Ave.		4	2,640	2,640	2,523	0	0	0	2,640	0	0	2,574
11	Z2-2ND FLR WEST	1	1	2,640	2,640	2,523	0	0	0	2,640	0	0	2,574
Zone	11 Total/Ave.				12,065	15,624	0	0	0	4,235	0	0	7,884
System	2 Total/Ave.			2 202	2,202	6,539	0	0	0	· o	0	0	0
12	23-BSMT SOUTH	1	1	2,202	2,202	6,539	0	0	0	0	0	0	0
Zone	12 Total/Ave.			3,780	3,780	9,473	0	0	0	0	0	0	0
. 13	Z2-BSMT SOUTH	1	1	3,700	3,780	9,473	0	0	0	0	0	0	0
Zone	13 Total/Ave.			7 405	3,685	8,091	0	0	0	0	0	0	49
14	Z1-BSNT SOUTH	1	1	3,685	3,685	8,091	0	0	0	0	0	0	49
Zone	14 Total/Ave.			/ 000		6,168	0	0	0	0	0	0	2,628
15	Z1-1ST FLR SOUTH		1	4,089	4,089 4,089	6,168	Ö	0	0	0	0	0	
Zone	15 Total/Ave.			4 003	=	2,415	0	0	0	0	501	14	3,171
	Z2-1ST FLR SOUTH		1	6,002	6,002 6,002	2,415	0	0	0	0	501	14	3,171
Zone	16 Total/Ave.			7 (70	3,430		0	0	-	0	0	0	- 1
	Z3-1ST FLR SOUTH		1	3,430			0	0		0	0	0	
Zone	17 Total/Ave.			E 7/7	3,430 5,763		0	0		5,763	0	0	
	Z3-2ND FLR SOUTH		1	5,763	5,763 5,763		0	0	0	5,763	0	0	
Zone	18 Total/Ave.			2.077	5,763		0	0	-	2,077	0		
	Z1-2ND FLR SOUTH		1	2,077	2,077		0	0		2,077	0		
Zone	19 Total/Ave.		_	F 404	2,077		0	0		5,681	0		
	Z2-2ND FLR SOUTH		1	5,681	5,681 5,681	2,220	0	0		5,681	0		
Zone	20 Total/Ave.				5,681		0	0		13,521	501		
System		•		1	36,710		0	0		21,991	501		
Buildi	ng				60,840	74,509	U	Ū	•	-1,771	231	•	

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2 ECO - EFFICIENT LIGHTING - BUILDING 300

System Totals

Percent	Cool	ing Loa	id	Heati	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	44 0	0	0	-120 054	27	000	10.005 /	٥	0	0.0	0	0
	11.0	•	•	-120,956	23	989	10,985.4	•	0	0.0	-	0
5 - 10	21.9	0	0	-241,912	18	774	21,970.8	0	U	0.0	0	U
10 - 15	32.9	0	0	-362,869	16	681	32,956.2	0	0	0.0	0	0
15 - 20	43.9	10	881	-483,825	13	564	43,941.6	0	0	0.0	0	0
20 - 25	54.8	17	1,526	-604,781	13	549	54,927.0	G	0	0.0	0	0
25 - 30	65.8	12	1,041	-725,737	8	372	65,912.4	G	0	0.0	0	0
30 - 35	76.8	8	678	-846,693	5	233	76,897.8	0	0	0.0	0	0
35 - 40	87.7	8	730	-967,650	5	218	87,883.2	0	0	0.0	. 0	0
40 - 45	98.7	5	445	-1,088,606	0	0	98,868.6	0	0	0.0	0	0
45 - 50	109.7	8	685	-1,209,562	0	0	109,854.0	0	0	0.0	0	0
50 - 55	120.6	7	603	-1,330,518	0	0	120,839.4	0	0	0.0	0	0
55 - 60	131.6	5	468	-1,451,474	0	0	131,824.8	0	0	0.0	0	0
60 - 65	142.6	5	456	-1,572,431	0	0	142,810.2	0	0	0.0	0	0
65 - 70	153.5	5	410	-1,693,387	0	0	153,795.6	0	0	0.0	0	0
70 - 75	164.5	3	258	-1,814,343	0	0	164,781.0	0	0	0.0	0	0
75 - 80	175.5	3	238	-1,935,299	0	0	175,766.4	0	0	0.0	0	0
80 - 85	186.4	2	148	-2,056,255	0	0	186,751.8	0	0	0.0	0	0
85 - 90	197.4	1	130	-2,177,211	0	0	197,737.2	0	0	0.0	0	0
90 - 95	208.4	1	63	-2,298,168	. 0	0	208,722.6	0	0	0.0	0	0
95 - 100	219.3	0	0	-2,419,124	0	0	219,708.0	100	8,760	0.0	0	0
Hours Off	0.0	0	0	0	0	4,380	0.0	0	0	0.0	0	8,760

------ MONTHLY ENERGY CONSUMPTION -----

	ELEC	DEMAND	GAS		GAS DMND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(kWh)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)
Jan	365,820	642	6,514	142	14
Feb	330,979	642	5,274	132	14
March	373,520	664	2,530	178	8
April	369,982	699	586	223	3
May	401,888	728	9	321	0
June	408,654	804	0	383	0
July	428,154	811	0	409	0
Aug	427,477	802	0	405	0
Sept	394,179	731	0	317	0
Oct	389,998	703	782	244	4
Nov	358,160	667	2,834	171	9
Dec	366,100	644	5,204	153	11
Total	4,614,913	811	23,732	3,078	14

Building Energy Consumption =

Januari I. Bakerari

297,893 (Btu/Sq Ft/Year)

Floor Area =

60,840 (\$q Ft)

Source Energy Consumption = 299,099 (Btu/Sq Ft/Year)

& Monthly KW = 8537

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

------UTILITY PEAK CHECKSUMS-----

Utility ELECTRIC DEMAND

Peak Value 811.3 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp.			Utility	Percnt
Ref.	Equipment		Demand	Of Tot
Num.	Code Name	Equipment Description	(kW)	(%)
Cooling	Equipment			
1	EQ1001S	2-STG CTV <555 TONS	176.4	21.75
2	EQ1122L	AIR-CLD RECIP >55 TONS	108.9	13.43
Sub Tota	ι		285.4	35.17
Sub Tota	ι		0.0	0.00
Air Movi	ng Equipment			
1		SUMMATION OF FAN ELECTRICAL DEMAND	48.5	5.98
2		SUMMATION OF FAN ELECTRICAL DEMAND	33.6	4.14
3		SUMMATION OF FAN ELECTRICAL DEMAND	119.4	14.71
Sub Tota	ι		201.4	24.83
Sub Tota	l		0.0	0.00
Miscella	neous			
Lights			88.3	10.89
Base Ut	ilities		0.0	0.00
Misc Eq	uipment		236.2	29.11
Sub Tota	ι		324.5	40.00
Grand To	tal		811.3	100.00

D8-26

	ZONE #1	
INSTALLED FIXTURES (IF):	· · · ·	EFFECTIVE LAMP FACTOR (ELF):
51 X 96 Watts =	4896 Watts	5393 Watts (observed) /
25 X 71 Watts =	1775 Watts	6671 Watts (installed fixtures)
Total Watts :	6671 Watts	= 0.81
		INSTALLED FIXT. X EFFECT. LAMP FACTOR
1.5 Watts/SF is assumme	d for existing lighting	41 Effective # of existing standard fixtures
3595 SF is the zone floor a	геа	20 Effective # of low—wattage fixtures
76 Total # of Fixtures		= 61 Total Fixtures
COST ESTIMATE:		TRACE 600 INPUT FOR LIGHTING ECO:
82 Replacement Lar	nps	1.21 Watts/SF
40 Replacement Bal	lasts	
	ZONE #2	2
INSTALLED FIXTURES (IF):		EFFECTIVE LAMP FACTOR (ELF):
25 X 96 Watts =	2400 Watts	2712 Watts (observed) /
13 X 71 Watts =	923 Watts	3323 Watts (installed fixtures)
Total Watts:	3323 Watts	= 0.82
		INSTALLED FIXT. X EFFECT. LAMP FACTOR
1.7 Watts/SF is assumme	d for existing lighting	20 Effective # of existing standard fixtures
1595 SF is the zone floor a	rea	11 Effective # of low-wattage fixtures
38 Total # of Fixtures		= 31 Total Fixtures
COST ESTIMATE:		TRACE 600 INPUT FOR LIGHTING ECO:
41 Replacement Lar	nps	1.38 Watts/SF
20 Replacement Bal	lasts	
	ZONE #3	3
INSTALLED FIXTURES (IF):		EFFECTIVE LAMP FACTOR (ELF):
55 X 96 Watts =	5280 Watts	1584 Watts (observed) /
28 X 71 Watts =	1988 Watts	7268 Watts (installed fixtures)
Total Watts :	7268 Watts	= 0.22
		INSTALLED FIXT. X EFFECT. LAMP FACTOR
0.6 Watts/SF is assumme	d for existing lighting	12 Effective # of existing standard fixtures
0040 001 4 0		0

24 Replacement Lamps

12 Replacement Ballasts

2640 SF is the zone floor area

83 Total # of Fixtures

COST ESTIMATE:

6 Effective # of low-wattage fixtures

TRACE 600 INPUT FOR LIGHTING ECO:

0.49 Watts/SF

18 Total Fixtures

ZONE #4 **INSTALLED FIXTURES (IF): EFFECTIVE LAMP FACTOR (ELF):** 25 X 96 Watts = 2400 Watts 2712 Watts (observed) / 12 X 71 Watts = 852 Watts 3252 Watts (installed fixtures) Total Watts: 3252 Watts 0.83 INSTALLED FIXT. X EFFECT. LAMP FACTOR 1.7 Watts/SF is assummed for existing lighting 21 Effective # of existing standard fixtures 1595 SF is the zone floor area 10 Effective # of low-wattage fixtures 37 Total # of Fixtures 31 Total Fixtures **COST ESTIMATE:** TRACE 600 INPUT FOR LIGHTING ECO: 42 Replacement Lamps 1.37 Watts/SF 21 Replacement Ballasts ZONE #5 INSTALLED FIXTURES (IF): **EFFECTIVE LAMP FACTOR (ELF):** 49 X 96 Watts = 4704 Watts 5280 Watts (observed) / 25 X 71 Watts = 1775 Watts 6479 Watts (installed fixtures) Total Watts: 6479 Watts 0.81 INSTALLED FIXT. X EFFECT. LAMP FACTOR 2.0 Watts/SF is assummed for existing lighting 40 Effective # of existing standard fixtures 2640 SF is the zone floor area 20 Effective # of low-wattage fixtures 74 Total # of Fixtures **60** Total Fixtures COST ESTIMATE: TRACE 600 INPUT FOR LIGHTING ECO: 80 Replacement Lamps 1.62 Watts/SF 40 Replacement Ballasts ZONE #6 **INSTALLED FIXTURES (IF): EFFECTIVE LAMP FACTOR (ELF):** 64 X 96 Watts = 6144 Watts 6560 Watts (observed) / 32 X 71 Watts = 2272 Watts 8416 Watts (installed fixtures) Total Watts: 8416 Watts 0.78 INSTALLED FIXT. X EFFECT. LAMP FACTOR 2.0 Watts/SF is assummed for existing lighting 50 Effective # of existing standard fixtures 3280 SF is the zone floor area 25 Effective # of low-wattage fixtures 96 Total # of Fixtures 75 Total Fixtures **COST ESTIMATE:** TRACE 600 INPUT FOR LIGHTING ECO:

1.62 Watts/SF

100 Replacement Lamps

50 Replacement Ballasts

ZONE #8 **INSTALLED FIXTURES (IF): EFFECTIVE LAMP FACTOR (ELF):** 30 X 96 Watts = 2880 Watts 3031 Watts (observed) / 15 X 71 Watts = 1065 Watts 3945 Watts (installed fixtures) Total Watts: 3945 Watts 0.77 INSTALLED FIXT. X EFFECT, LAMP FACTOR 1.9 Watts/SF is assummed for existing lighting 23 Effective # of existing standard fixtures 1595 SF is the zone floor area 12 Effective # of low-wattage fixtures 45 Total # of Fixtures 35 Total Fixtures **COST ESTIMATE:** TRACE 600 INPUT FOR LIGHTING ECO: 46 Replacement Lamps 1.54 Watts/SF 23 Replacement Ballasts ZONE #9 **INSTALLED FIXTURES (IF): EFFECTIVE LAMP FACTOR (ELF):** 56 X 96 Watts = 5376 Watts 5280 Watts (observed) / 28 X 71 Watts = 1988 Watts 7364 Watts (installed fixtures) Total Watts: 7364 Watts 0.72 INSTALLED FIXT. X EFFECT, LAMP FACTOR 2.0 Watts/SF is assummed for existing lighting 40 Effective # of existing standard fixtures 2640 SF is the zone floor area 20 Effective # of low-wattage fixtures 84 Total # of Fixtures **60** Total Fixtures COST ESTIMATE: TRACE 600 INPUT FOR LIGHTING ECO: 80 Replacement Lamps 1.62 Watts/SF 40 Replacement Ballasts **ZONE #10 INSTALLED FIXTURES (IF): EFFECTIVE LAMP FACTOR (ELF):** 25 X 96 Watts = 2400 Watts 2712 Watts (observed) / 12 X 71 Watts = 852 Watts 3252 Watts (installed fixtures) Total Watts: 3252 Watts 0.83INSTALLED FIXT. X EFFECT, LAMP FACTOR 1.7 Watts/SF is assummed for existing lighting 21 Effective # of existing standard fixtures 1595 SF is the zone floor area 10 Effective # of low-wattage fixtures 37 Total # of Fixtures 31 Total Fixtures **COST ESTIMATE:** TRACE 600 INPUT FOR LIGHTING ECO:

1.37 Watts/SF

42 Replacement Lamps

21 Replacement Ballasts

ZONE #11

INSTALLED FIXTURES (IF):

51 X 96 Watts =

4896 Watts 25 X 71 Watts =

1.5 Watts/SF is assummed for existing lighting

Total Watts:

2640 SF is the zone floor area

76 Total # of Fixtures

1775 Watts

6671 Watts

EFFECTIVE LAMP FACTOR (ELF):

3960 Watts (observed) /

6671 Watts (installed fixtures)

0.59

INSTALLED FIXT. X EFFECT. LAMP FACTOR

30 Effective # of existing standard fixtures

15 Effective # of low-wattage fixtures

45 Total Fixtures

COST ESTIMATE: 60 Replacement Lamps

30 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.21 Watts/SF

ZONE #12

INSTALLED FIXTURES (IF):

55 X 96 Watts =

5280 Watts

27 X 71 Watts = Total Watts: 1917 Watts

7197 Watts

EFFECTIVE LAMP FACTOR (ELF):

4404 Watts (observed) /

7197 Watts (installed fixtures)

0.61

2.0 Watts/SF is assummed for existing lighting

2202 SF is the zone floor area

82 Total # of Fixtures

INSTALLED FIXT. X EFFECT. LAMP FACTOR

34 Effective # of existing standard fixtures

17 Effective # of low-wattage fixtures

50 Total Fixtures

COST ESTIMATE:

68 Replacement Lamps

34 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.62 Watts/SF

ZONE #13

INSTALLED FIXTURES (IF):

57 X 96 Watts = 29 X 71 Watts = 5472 Watts

2059 Watts

Total Watts:

7531 Watts

EFFECTIVE LAMP FACTOR (ELF):

7560 Watts (observed) /

7531 Watts (installed fixtures)

1.00

2.0 Watts/SF is assummed for existing lighting

3780 SF is the zone floor area

86 Total # of Fixtures

INSTALLED FIXT. X EFFECT. LAMP FACTOR

57 Effective # of existing standard fixtures

29 Effective # of low-wattage fixtures

86 Total Fixtures

COST ESTIMATE:

114 Replacement Lamps 57 Replacement Ballasts TRACE 600 INPUT FOR LIGHTING ECO:

1.62 Watts/SF

ZONE #14

INSTALLED FIXTURES (IF):

5184 Watts

EFFECTIVE LAMP FACTOR (ELF): 7376 Watts (observed) /

54 X 96 Watts = 27 X 71 Watts =

1917 Watts

7101 Watts (installed fixtures)

Total Watts:

7101 Watts

1.04

2.0 Watts/SF is assummed for existing lighting

3688 SF is the zone floor area

81 Total # of Fixtures

INSTALLED FIXT. X EFFECT. LAMP FACTOR

56 Effective # of existing standard fixtures

28 Effective # of low-wattage fixtures

84 Total Fixtures

COST ESTIMATE:

108 Replacement Lamps

54 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.62 Watts/SF

ZONE #15

INSTALLED FIXTURES (IF):

84 X 96 Watts =

8064 Watts

42 X 71 Watts =

2982 Watts

11046 Watts

EFFECTIVE LAMP FACTOR (ELF):

7769 Watts (observed) /

11046 Watts (installed fixtures)

0.70

1.9 Watts/SF is assummed for existing lighting

4089 SF is the zone floor area

Total Watts:

126 Total # of Fixtures

INSTALLED FIXT. X EFFECT. LAMP FACTOR

59 Effective # of existing standard fixtures

30 Effective # of low-wattage fixtures

89 Total Fixtures

COST ESTIMATE:

TRACE 600 INPUT FOR LIGHTING ECO:

118 Replacement Lamps

1.54 Watts/SF

74 Replacement Ballasts (18 Dimming Ballasts)

ZONE #16

INSTALLED FIXTURES (IF):

94 X 96 Watts =

9024 Watts

EFFECTIVE LAMP FACTOR (ELF): 12004 Watts (observed) /

46 X 71 Watts =

3266 Watts

12290 Watts (installed fixtures)

Total Watts:

12290 Watts

0.98

2.0 Watts/SF is assummed for existing lighting

6002 SF is the zone floor area

140 Total # of Fixtures

INSTALLED FIXT. X EFFECT, LAMP FACTOR

92 Effective # of existing standard fixtures

45 Effective # of low-wattage fixtures

137 Total Fixtures

COST ESTIMATE:

184 Replacement Lamps

92 Replacement Ballasts

TRACE 600 INPUT FOR LIGHTING ECO:

1.62 Watts/SF

ZONE #	17
INSTALLED FIXTURES (IF):	EFFECTIVE LAMP FACTOR (ELF):
55 X 96 Watts = 5280 Watts	6862 Watts (observed) /
28 X 71 Watts = 1988 Watts	7268 Watts (installed fixtures)
Total Watts: 7268 Watts	= `0.94
	INSTALLED FIXT. X EFFECT, LAMP FACTOR
2.0 Watts/SF is assummed for existing lighting	52 Effective # of existing standard fixtures
3431 SF is the zone floor area	26 Effective # of low-wattage fixtures
83 Total # of Fixtures	= 78 Total Fixtures
COST ESTIMATE:	TRACE 600 INPUT FOR LIGHTING ECO:
104 Replacement Lamps	1.62 Watts/SF
52 Replacement Ballasts	
ZONE #	18
INSTALLED FIXTURES (IF):	EFFECTIVE LAMP FACTOR (ELF):
116 X 96 Watts = 11136 Watts	8643 Watts (observed) /
58 X 71 Watts = 4118 Watts	15254 Watts (installed fixtures)
Total Watts: 15254 Watts	= 0.57
	INSTALLED FIXT. X EFFECT. LAMP FACTOR
1.5 Watts/SF is assummed for existing lighting	66 Effective # of existing standard fixtures
5762 SF is the zone floor area	33 Effective # of low-wattage fixtures
174 Total # of Fixtures	= 99 Total Fixtures
COST ESTIMATE:	TRACE 600 INPUT FOR LIGHTING ECO:
132 Replacement Lamps	1.21 Watts/SF
66 Replacement Ballasts	
ZONE #	
INSTALLED FIXTURES (IF):	EFFECTIVE LAMP FACTOR (ELF):
28 X 96 Watts = 2688 Watts	3946 Watts (observed) /
14 X 71 Watts = 994 Watts	3682 Watts (installed fixtures)
Total Watts: 3682 Watts	= 1.07
	INSTALLED FIXT. X EFFECT. LAMP FACTOR
1.9 Watts/SF is assummed for existing lighting	30 Effective # of existing standard fixtures
2077 SF is the zone floor area	15 Effective # of low-wattage fixtures
42 Total # of Fixtures	= 45 Total Fixtures
COST ESTIMATE.	TDAGE OOG INDLIT FOR LIGHTING FOO
COST ESTIMATE:	TRACE 600 INPUT FOR LIGHTING ECO:
56 Replacement Lamps	1.54 Watts/SF
28 Replacement Ballasts	

ZONE #20

INSTALLED FIXTURES (IF):

92 X 96 Watts =

Total Watts:

5681 SF is the zone floor area

138 Total # of Fixtures

8832 Watts

46 X 71 Watts =

3266 Watts

12098 Watts

EFFECTIVE LAMP FACTOR (ELF):

11362 Watts (observed) /

12098 Watts (installed fixtures)

= 0.94

INSTALLED FIXT. X EFFECT. LAMP FACTOR

86 Effective # of existing standard fixtures

43 Effective # of low-wattage fixtures

= 130 Total Fixtures

COST ESTIMATE:

172 Replacement Lamps

86 Replacement Ballasts

2.0 Watts/SF is assummed for existing lighting

TRACE 600 INPUT FOR LIGHTING ECO:

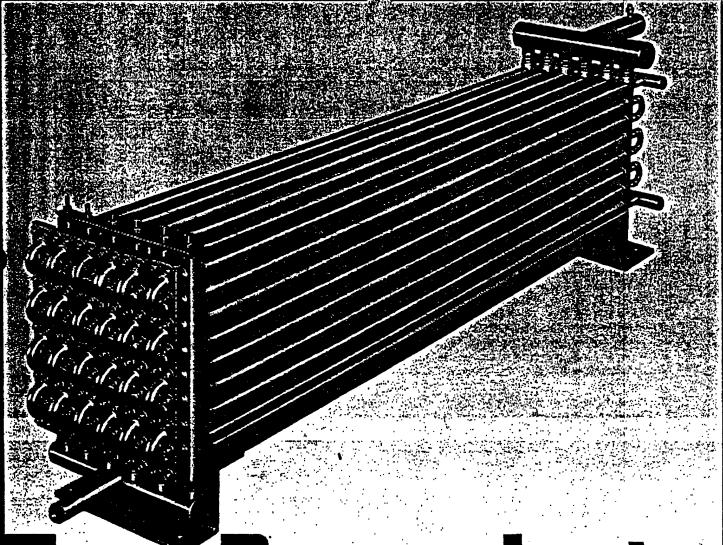
1.62 Watts/SF

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO: DACA 83-91-C-018 PROJECT TITLE: BLDG. 300 - CONSOLIDATED CHILLER PLANT WITH HEAT RECOVERY FISCAL YEAR: 1992 DISCRETE PORTION NAME: TOTAL ANALYSIS DATE: 07/09/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER 1 INVESTMENT A. CONSTRUCTION COST = \$91,996 B. SIOH COST (6.0% of 1A) = \$5,060 C. DESIGN COST (6.0% of 1A) = \$5,520 D. ENERGY CREDIT (1A + 1B + 1C) = \$102,575 E. SALVAGE VALUE = \$0 F. TOTAL INVESTMENT (1D - 1E) = \$0 F. TOTAL INVESTMENT (1D - 1E) = \$102,575 2 ENERGY SAVINGS (+) / COST (-) FUEL TYPE FUEL COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED SMBTU (1) MBTUYYR (2) SAVINGS (3) FACTOR (4) SAVINGS (5) A. ELEC \$6.48 3777 \$2,440 15.23 \$37,159 B. DIST 0 \$0 17.28 \$0 C. NAT GAS \$2.21 2.231 \$4,935 19.64 \$96,923 D. PAPER 0 \$0 \$0 17.28 \$0 C. NAT GAS \$2.21 2.231 \$4,935 19.64 \$96,923 D. PAPER 0 \$0 \$0 16.22 \$0 F. TOTAL COST (-) F. TOTAL COST (-) A. ANNUAL RECURRING (+) / COST (-)	4 Pi		REGION	Danas	a Sande Missil	LOCATION: Whit	
DISCRETE PORTION NAME: TOTAL ANALYSIS DATE: 07/09/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER 1 INVESTMENT A. CONSTRUCTION COST = \$91,996 B. SIOH COST (6.5% of 1A) = \$5,060 C. DESIGN COST (6.0% of 1A) = \$5,520 D. ENERGY CREDIT (1A + 1B + 1C) = \$102,575 E. SALVAGE VALUE = \$0 F. TOTAL INVESTMENT (1D - 1E) = \$0 \$102,575 2 ENERGY SAVINGS (+) / COST (-) FUEL TYPE FUEL COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED \$MBTU (1) MBTU/YR (2) SAVINGS (3) FACTOR (4) SAVINGS (5) A. ELEC \$6.48 377 \$2,440 15.23 \$37,159 B. DIST 0 \$0 17.28 \$50 C. NAT GAS \$2.21 2,231 \$4,935 19.64 \$96,923 D. PAPER 0 \$50 E. COAL \$0 16.22 \$50 F. TOTAL INVESTINGS (+) / COST (-) E. COAL \$0 16.22 \$50 F. TOTAL 2,607 7,374.9 \$50,469 SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+) / COST (-) A. ANNUAL RECURRING (+) / COST (-)				Lange	o oanao mioon		
ANALYSIS DATE: 07/09/92 ECONOMIC LIFE: 25 PREPARED BY: A. STOVER 1 INVESTMENT A. CONSTRUCTION COST	RECOVERY F	I HEAT I	R PLANT	ONSOLIDATED CHILL	BLDG. 300 -	PROJECT TITLE:	
1 INVESTMENT A. CONSTRUCTION COST				OTAL	ON NAME:	DISCRETE PORTIO	
A. CONSTRUCTION COST = \$91,996 B. SICH COST (5.5% of 1A) = \$5,060 C. DESIGN COST (6.0% of 1A) = \$5,520 D. ENERGY CREDIT (1A + 1B + 1C) = \$102,575 E. SALVAGE VALUE = \$50 F. TOTAL INVESTMENT (1D - 1E) = \$102,575 2 ENERGY SAVINGS (+) / COST (-) FUEL TYPE FUEL COST SAVINGS ANNUAL\$ DISCOUNT DISCOUNTED \$/MBTU (1) MBTU/YR (2) SAVINGS (3) FACTOR (4) SAVINGS (5) A. ELEC \$6.48 377 \$2,440 15.23 \$37,159 B. DIST 0 \$0 17.28 \$0 C. NAT GAS \$2.21 2.231 \$4,935 19.64 \$96,923 D. PAPER 0 \$0 \$0 \$0 E. COAL \$0 16.22 \$0 F. TOTAL 2,607 7,374.9 \$134,085 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS & = \$8,469	25 Pi	FE: 2	ECONON		07/09/92	ANALYSIS DATE:	
A. CONSTRUCTION COST = \$91,996 B. SICH COST (5.5% of 1A) = \$5,060 C. DESIGN COST (6.0% of 1A) = \$5,520 D. ENERGY CREDIT (1A + 1B + 1C) = \$102,575 E. SALVAGE VALUE = \$50 F. TOTAL INVESTMENT (1D - 1E) = \$102,575 2 ENERGY SAVINGS (+) / COST (-) FUEL TYPE FUEL COST SAVINGS ANNUAL\$ DISCOUNT DISCOUNTED \$/MBTU (1) MBTU/YR (2) SAVINGS (3) FACTOR (4) SAVINGS (5) A. ELEC \$6.48 377 \$2,440 15.23 \$37,159 B. DIST 0 \$0 17.28 \$0 C. NAT GAS \$2.21 2.231 \$4,935 19.64 \$96,923 D. PAPER 0 \$0 \$0 \$0 E. COAL \$0 16.22 \$0 F. TOTAL 2,607 7,374.9 \$134,085 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS & = \$8,469						ESTMENT	1 INV
B. SIOH COST (5.5% of 1A) = \$5,060 C. DESIGN COST (8.0% of 1A) = \$5,520 D. ENERGY CREDIT (1A + 1B + 1C) = \$102,575 E. SALVAGE VALUE = \$0 F. TOTAL INVESTMENT (1D - 1E) = \$102,575 2 ENERGY SAVINGS (+) / COST (-) FUEL TYPE FUEL COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED \$7MBTU (1) MBTU/YR (2) SAVINGS (3) FACTOR (4) SAVINGS (5) A. ELEC \$6.48 377 \$2,440 15.23 \$37,159 B. DIST 0 \$0 \$17.28 \$0 C. NAT GAS \$2.21 2,231 \$4,935 19.64 \$96,923 D. PAPER 0 \$0 \$0 \$17.28 \$0 E. COAL \$0 \$16.22 \$0 F. TOTAL 2,607 7,374.9 \$134,083 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS & = \$6,469				=	COST		
C. DESIGN COST (6.0% of 1A) = \$5,520 D. ENERGY CREDIT (1A + 1B + 1C) = \$102,575 E. SALVAGE VALUE = \$0 F. TOTAL INVESTMENT (1D - 1E) = \$102,575 2 ENERGY SAVINGS (+) / COST (-) FUEL TYPE FUEL COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED \$/MBTU (1) MBTU/YR (2) SAVINGS (3) FACTOR (4) SAVINGS (5) A. ELEC \$6.48 377 \$2,440 15.23 \$37,159 B. DIST 0 \$0 17.28 \$0 C. NAT GAS \$2.21 2,231 \$4,935 19.64 \$96,923 D. PAPER 0 \$0 \$0 \$0 E. COAL \$0 16.22 \$0 F. TOTAL 2,607 7,374.9 \$134,083 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS & \$56,469				(5.5% of 1A) =			
D. ENERGY CREDIT (1A+1B+1C) = \$102,575 E. SALVAGE VALUE = \$0 F. TOTAL INVESTMENT (1D-1E) = \$102,575 2 ENERGY SAVINGS (+) / COST (-) FUEL TYPE FUEL COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED \$7/MBTU (1) MBTU/YR (2) SAVINGS (3) FACTOR (4) SAVINGS (5) A. ELEC \$6.48 377 \$2,440 15.23 \$37,159 B. DIST 0 \$0 17.28 \$0 C. NAT GAS \$2.21 2,231 \$4,935 19.64 \$96,923 D. PAPER 0 \$0 \$0 16.22 \$0 F. TOTAL \$0 \$6,007 7,374.9 \$134,083 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS & \$86,469							
E. SALVAGE VALUE				•		ENERGY CREDIT	D.
2 ENERGY SAVINGS (+) / COST (-) FUEL TYPE FUEL COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED \$/MBTU (1)						SALVAGE VALUE	E.
FUEL TYPE FUEL COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED \$/MBTU (1) MBTU/YR (2) SAVINGS (3) FACTOR (4) SAVINGS (5) A. ELEC \$6.48 377 \$2,440 15.23 \$37,159 B. DIST 0 \$0 17.28 \$0 C. NAT GAS \$2.21 2,231 \$4,935 19.64 \$96,923 D. PAPER 0 \$0 \$0 E. COAL \$0 16.22 \$0 F. TOTAL 2,607 7,374.9 \$134,083 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS & \$\$5,469\$				(1D – 1E) =	NT	TOTAL INVESTME	F.
\$/MBTU (1)					/ COST (-)	ERGY SAVINGS (+)	2 EN
A. ELEC \$6.48 377 \$2,440 15.23 \$37,159 B. DIST 0 \$0 17.28 \$0 C. NAT GAS \$2.21 2,231 \$4,935 19.64 \$96,923 D. PAPER 0 \$0 \$0 E. COAL \$0 16.22 \$0 F. TOTAL 2,607 7,374.9 \$134,082 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS & = \$6,469	DISCOUNT	UAL\$		SAVINGS	FUEL COST	FUEL TYPE	
A. ELEC \$6.48 377 \$2,440 15.23 \$37,159 B. DIST 0 \$0 17.28 \$0 C. NAT GAS \$2.21 2,231 \$4,935 19.64 \$96,923 D. PAPER 0 \$0 \$0 E. COAL \$0 16.22 \$0 F. TOTAL 2,607 7,374.9 \$134,085 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS & \$\$6,469\$	FACTOR (4)	GS (3)	,	MBTU/YR (2)	\$/MBTU (1)		
C. NAT GAS \$2.21 2,231 \$4,935 19.64 \$96,923 D. PAPER 0 \$0 \$0 E. COAL \$0 16.22 \$0 F. TOTAL 2,607 7,374.9 \$134,083 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS & \$6,469	15.23	2,440		377	\$6.48	ELEC	A.
D. PAPER 0 \$0 \$0 \$0 E. COAL \$0 16.22 \$0 F. TOTAL 2,607 7,374.9> \$134,082 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS & \$8,469	17.28	\$0		0		DIST	В.
E. COAL \$0 16.22 \$0 F. TOTAL 2,607 7,374.9> \$134,083 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS & = \$6,469	19.64	4,935		2,231	\$2.21	NAT GAS	C.
F. TOTAL 2,607 7,374.9> \$134,083 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS & \$6,469		\$0		0		PAPER	D.
3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS & \$6,469	16.22	\$0				COAL	E.
A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS & = \$6,469		,374.9		2,607		TOTAL	F.
)	GS (+) / COST	N-ENERGY SAVIN	3 NC
MAINTENANCE COST SAVINGS)		=		. DEMAND SAVINGS &	RING (+/-) (ELE	ANNUAL RECURR	A.
					OST SAVINGS	MAINTENANCE CO	
1 DISCOUNT FACTOR (From Table A-2) = 14.68	14.68	A-2) =	(From		TOR	1 DISCOUNT FAC	
2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = \$94,958		3A1) =		ST (-)	SAVINGS (+) / C	2 DISCOUNTED S	
B. NON-RECURRING (+/-)					3 (+/-)	NON-RECURRING	В.
ITEM YEAR OF DISCOUNT DISCOUNTED	DISCOUNT	AR OF				ITEM	
SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4)	FACTOR (3)	CE (2)	occu	SAVINGS (1)			
a. \$0 0.00 \$0	0.00			\$0		a.	
b. \$0 0.00 \$0	0.00			\$0		b.	
c. \$0 0.00 \$0	0.00			\$0		c.	
d TOTAL \$0 \$0				•			
C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$94,950	(3A2 + 3Bd4) =		T (-)	'ED SAVINGS (+) / COS			
D. PROJECT NON-ENERGY TEST							D.
1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$44,247	(2F5 x 0.33) =			CALCULATION			
a IF 3D1 => 3C THEN GO TO 4					•		
b F 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 1.74	(2F5 + 3D1) / 1F =			E SIR			
c IF 3D1b => 1 THEN GO TO 4							
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY				OES NOT QUALIFY	HEN PROJECT	d IF 3D1b < 1 Th	
4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$13,843	+ 3A + (3B1d/25)) =	(2F3 +		OSTS (-)	SAVINGS (+) /	ST YEAR DOLLAR	4 FIF
5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$229,040					ITED SAVINGS	TAL NET DISCOUN	5 TO
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 2.23	(5/1F) =			MENT RATIO (SIR)	S-TO-INVES	COUNTED SAVING	6 DIS
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)				OT QUALIFY)	OJECT DOES	SIR < 1 THEN PRO	(II
7 SIMPLE PAYBACK (SPB) (1F/4) = 7.4	(1F/4) =				PB)	IPLE PAYBACK (SF	7 SI

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NMC							
CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SO	JTH WADSW	ORTH BLV	D., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO) 80227	
CONTRACT	CONTRACT FOR (Work to be performed) CENTRAL CHILLER PLANT WITH HEAT RECOVERY -	COVERY -	BLDG 300				PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
				MATERIAL COST	L cost		LABOR COSTS			
Line	Item	o Či	Quantity			Manhours	Average		Other Direct	Line
No.	(1)	Measure (2)	ල	جة (4)	Total (5)	Mandays (6)	Rate	Total (8)	Cost s (9)	Total (10)
	CNTRL CHILLER PLANT W/ HEAT RECOVERY						,			
	100 Ton Water-Cooled Reciprocating Chiller	EA	1	31500	31500	266.00	35.81	9525.46		\$41,025.46
	Hot Gas Heat Exchanger	EA	1	4500	4500.00	40.00	35.81	1432.40		\$5,932.40
	6000 gal. HW Storage Tanks w/ Pipe Connections	Ę	က	5000	15000.00	40.00	35.81	4297.20		\$19,297.20
	HW Storage Tank Insulation	R	1200	2.64	3168.00	0.20	35.81	8594.40		\$11,762.40
	Hot Water Circulation Pumps	EA	3	605.00	1815.00	3.20	35.81	343.78		\$2,158.78
	Hot Water Piping (2 in.)	1	640	3.81	2438.40	0.25	35.81	5729.60		\$8,168.00
	Hot Water Pipe Insulation (2 in.)	F.	640	1.98	1267.20	0.08	35.81	1833.47		\$3,100.67
	Controls	Œ	3	156.00	468.00	1.00	27.60	82.80		\$550.80
	TOTAL THIS SHEET									\$91,995.71
	Source: Means Electric & Mechanical Cost Data, 1932; Haynes Trans Co., Denver CO, Material	Jenver CO; Materi	al costs include 2	25% overhead &	costs include 25% overhead & profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1	U.S. Dept. of Labor,	General Wage Deci	sion No. NM91-1		

How to save twice with one product.



Trané Desuperheater

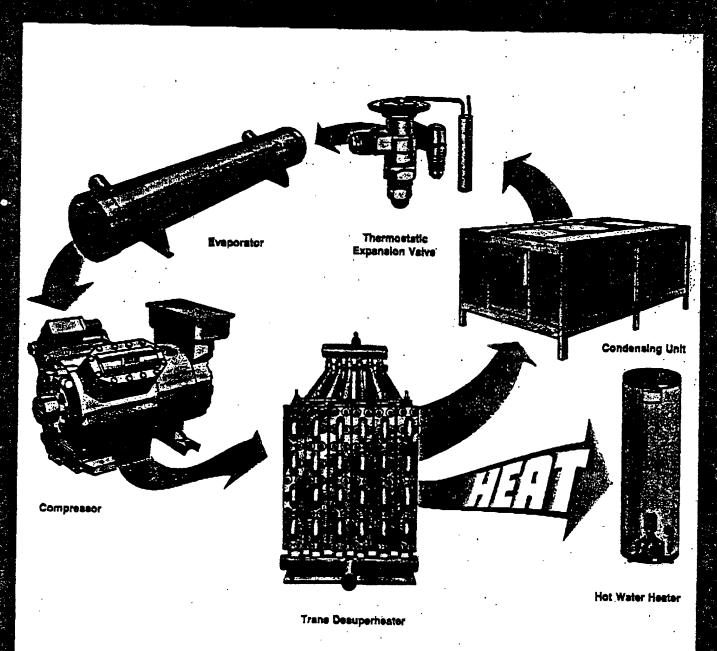


How it works

The energy efficient Trane desuperheater is installed in the hot gas line between your unit's compressor and condenser. As hot refrigerant enters the desuperheater, it moves onto a roll-formed spiral surface that creates a swirting path for the refrigerant to tollow. The turbulence created by this innovative design makes it exister for the refrigerant to give up its heat.

At the same time, cold water is piped into a copper tube beneath the spiral surface. Here it receives the heat transferred from the refrigerant and then continues its path according to one of the following systems: Circulating—used in applications with a varying demand for holwater or with a need for extra hol water. After being heated by the desuperheater, the water flows into a water storage lank. As long as the compressor is in operation; a pump continuously circulates water from the storage tank through the desuperheater, raising the water temperature with each pass.

Preheat used in applications with continuous compressor operation and a constant demand for not water. Water flows directly from the desuperheater into the building's hot water heater.



Reclaim waste heat while increasing unit EER's.

New Trane desuperheaters put your air conditioner's waste heat to work while increasing your unit's efficiency by up to 12 percent! Saving you valuable energy dollars two ways — with a payback period as low as one year!

PROVIDING 'FREE' HOT WATER

Trane desuperheaters save energy by recovering waste heat normally rejected by your air conditioner and using it to heat domestic or process water. This adds up to significant energy savings when considering that a typical 40-ton air-cooled system

can generate 192 gallons of hot water per hour! Assuming that 40 tons is a continuous average load and the electrical rate is 5¢ per kwh, the Trane desuperheater can save you \$37 per day. That's \$4,440 for 120 days of operation!

CALCULATE YOUR SAVINGS

The following table estimates the maximum number of gallons of hot water the new Trane desuperheater can produce. The gallons shown are based on ARI* standards for temperature rises of 75 F to 140 F and 115 F to 140 F.

Air Conditioning Unit	GPM/GPH 75-140*	BTU/HR SAVED		BTU/HR
Size at Full Load 10 20 30 40 50 60	0.8/48 1.8/96 2.4/144 3.2/192 4.0/240 4.8/288 5.6/338	26,000 52,000 78,000 104,000 130,000 156,000	1.9/114 3.8/228 5.7/342 7.6/456 9.5/570 11.4/684	23,750 47,500 71,250 95,000 118,750 142,500 186,250
90 100	6.4/384 7.2/432 8.0/480	208,000 234,000 260,000	15.2/912 17.1/1026 19.0/1140	190,000 213,750 237,500

 ¹⁹⁸⁰ Air Conditioning and Refrigeration Institute Standard 470 for desuperheater/water heaters.

To estimate your savings:

- Reference the above table and multiply the number of gallons of hot water per hour which can be generated by your air conditioning unit by the number of hours of unit operation per day. Enter the nomograph at point A with this value.
- Next, follow a horizontal line across the desuperheater savings nomograph to the water temperature rise desired.

Water Temperature = Rise (ΔTw)

Desired Temperature of Water Leaving the Desuperheater (LWT)

Temperature
Water Entering
the Desuperheater
(EWT)

 To calculate the value of 100,000 Btu of reclaimed heat you can obtain, use the following formula:

Once you have calculated your cost of fuel per 100.000 Btu's, drop vertically from point B to your calculated value at point C.

- 4) Your estimated savings in dollars per day can now be found by moving horizontally to the left on the nomograph to point D.
- 5) Take the savings obtained from step 4 and Insert It into the following formula:

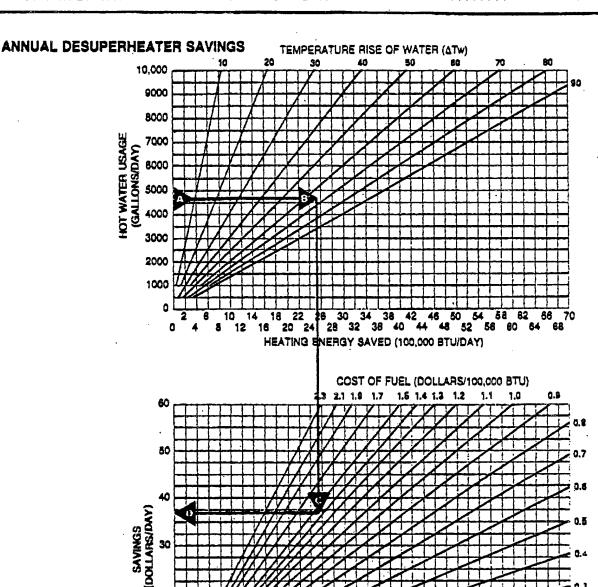
This number is the expected amount of days the air conditioner will run and heat can be reclaimed.

The following are average unit prices and heating values of several common fuels:

TO SE LA MADISTRA	Unit Price	Content & Sticlen	Cost/100,000 BTU
#2 Fuel Oll #	1 Z0/gallon 1 140,00	Btu/kwhi	114
Natural Gas	0.38/them)\$\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	Blu/therm 3 80%	0.48
#Propage / / / / /	0.80/gailon ()	Biu/gallon 3 3 80%	1.10

* Unit prices and coat/100,000 BTU will vary depending on your location.

THE THANE COMPANY 1982





A 40-ton unit operating at full capacity can generate 192 gallons of hot water per hour when heated from 75 F to 140 F. This is equal to 4,608 gallons per day. Locate 4,608 gallons per day on the nomograph (point A).

10

- 2. The ΔT_{ω} is 140 F 75 F = 65 F. Follow the horizontal line at 4,608 gallons per day across to 65 F T_{ω} (point B).
- Drop vertically to the lower section of the nomograph to the cost per 100,000 Btu. In this case let's use an electric water heater at \$0.05 per kwh to yield a cost of \$1.47 per 100,000 Btu (point C).
- 4. Run horizontally to the left to \$37/day savings (point D).
- if this air conditioning unit operated at full capacity for 120 days per year, the desuperheater would provide the following yearly savings:

$$\frac{$37}{\text{day}} \times 120 \text{ operating days/year} = \frac{$4,440}{\text{year}}$$

Depending on the installation, this savings could result in a payback period as low as one year!

UP TO 12% HIGHER OPERATING EFFICIENCIES

But the energy savings derived from Trans desuperheaters continue beyond 'free' hot water. Desuperheaters also deliver increased unit efficiency.

Desuperheaters remove heat from the discharge gas before it reaches the condenser coil. This allows the condenser to work more efficiently and, in turn, allows your air conditioner to provide more cooling with the same amount of energy or less, increasing your total unit operating efficiency by up to 12 percenti

PAGE 1

esos study at wisher - building 300
white sands missile range MM
us army
emc engineers, inc.
range control bldg: alt 1-bsln, altz-eco Central Choller Plant with Waste Heat Recovery

Weather File Code:	ELPASO).W
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 18: 5:

18: 5:50 3/13/92

3.9171 (Lb-min./hr/cuft)

Dataset Name:

Enthalpy Factor:

300 .TM

Opt Vent

Total

0.0

-340.6

0

0.0

0.0

Rm Exh

Auxil

System Block ממ - DOUBLE DUCT Peaked at Time ==> Mo/Hr: 7/16 Mo/Hr: 7/16 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 OADB: 97 OADB: 24 Ret. Air Ret. Air Space Net Percnt Space Percnt * Space Peak Coil Peak Percot Sens.+Lat. Sensible Latent Total Of Tot Sensible Of Tot * Space Sens Of Tot Tot Sens Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr 0 0 0.00 O 0.00 0 0 0.00 Skylite Cond 0 0 0 0.00 0 0.00 n 0 0.00 Roof Cond 0 12,734 12,734 2.70 0.00 0 0 -13,550 3.56 Glass Solar 0 0 n 0.00 0 0.00 0 0.00 Glass Cond 0 0 0 0.00 0 0.00 0 0 0.00 Wall Cond 81,136 27,781 108,917 23.06 81,117 28.85 -128,969 -173,237 45.46 Partition -4,965 -4,965 -1.05 -4,965 -1.77 -60,134 -60,134 15.78 Exposed Floor 0.00 0.00 * n 0 0.00 Infiltration 6,185 6,185 1.31 7,886 2.80 -14,848 -14,848 3.90 Sub Total ==> 82,355 40,515 122,871 26.01 84,038 29.88 -203,952 -261,770 68.69 Internal Loads Lights 60,341 60,341 12.77 60,341 21.46 0 0.00 People 27,300 27,300 5.78 14,950 5.32 0 0.00 Misc 103,877 0 n 103,877 21.99 103,877 36.94 0 0.00 Sub Total ==> 191,518 0 191,518 40.54 179,168 63.71 0 0.00 Ceiling Load 3,991 -3,991 0.00 3,230 1.15 -4,628 0.00 Outside Air 62,240 13.18 0.00 0 -149,417 39,21 Sup. Fan Heat 84,211 17.83 0.00 84,211 -22.10 Ret. Fan Heat O 0 0.00 0.00 0 0.00 Duct Heat Pkup n 0 0.00 0.00 0 0.00 OV/UNDR Sizing 14,770 14,770 3.13 5.25 14,770 -58,220 -58,220 15.28 Exhaust Heat -3,250 0 -3,250 -0.69 0.00 4,116 -1.08 Terminal Bypass 0 0 -0.00 0 0.00 0.00 Grand Total ==> 292,634 33.274 472,359 100.00 * 281,206 100.00 -381,080 -266,799 100.00 -----COOLING COIL SELECTION-----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/W8/HR Leaving DB/WB/HR **Gross Total** Glass (sf) (%) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 12,065 Main Clg 39.4 472.4 478.2 46,440 74.7 58.0 56.8 63.8 54.1 57.3 Part 17,254 Aux Clg 0.0 0.00.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 0 Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 4,235 Totals 39.4 472.4 Wall 8,132 -----HEATING COIL SELECTION----------AIRFLOWS (cfm)------- ENGINEERING CHECKS ----TEMPERATURES (F)---Capacity Coil Airfl Lvg Type Cooling **Heating** Clg % OA 7.0 Type Clg Htg (Mbh) (cfm) Deg F Deg F Vent 3,251 3,251 Clg Cfm/Sqft 3.85 SADB 65.7 78.0 Main Htg -340.6 46,440 70.3 78.0 Infil 323 323 Clg Cfm/Ton 1179.78 Plenum 73.0 70.5 Aux Htg 0.0 0 0.0 0.0 Supply 46,440 46,440 Clg Sqft/Ton 306.51 Return 73.0 70.7 Preheat -0.0 46,440 67.4 63.8 Mincfm 0 Clg Btuh/Sqft 39.15 Ret/OA 74.7 Reheat 0.0 0 0.0 0.0 Return 46,440 46,440 No. People 65 72.0 Runarnd **Humidif** 0.0 0 0.0 0.0 Exhaust 3,251 3,251 Htg % OA 7.0 Fn MtrTD 0.6 0.0

0

Htg Cfm/SqFt

Htg Btuh/SqFt

3.85

-28.23

Fn BldTD

Fn Frict

0.5

1.4

0.0

0.0

System	2	Block	DD	-	DOUBLE DUCT
--------	---	-------	----	---	-------------

	Peaked	********* at Time =	==>	Mo (Un-	7/16				4			_				****
		e Air ==>		Mo/Hr:					*	Mo/Hr:		*	Mo.	/Hr: 13/ 1		
	outside	e XII>	U	ADB/MB/HK:	97/ 64/ 49	7.0			*	OADB:	97	*	O	ADB: 24		
			Space	Pet Ai	r Ret. Air		Mat	Donant	-			*				
			Sens.+Lat.	Sensibl			otal	Percnt Of Tot		Space	Percnt		e Peak	Coil Peak		Percn
	Envelor	pe Loads	(Btuh)	(Btuh			tuh)			ensible	Of Tot		e Sens	Tot Sens		Of To
	•	ite Solr	0		0	(6	0	(%) 0.00		(Btuh)	(%)		(Btuh)	(Btuh)		(%
		ite Cond	0		0		0			. 0	0.00		0	0		0.0
	Roof		0		-	42	-	0.00		0	0.00		0	0		0.0
		Solar	0	,	0	12	,709	2.03		0	0.00		0	-13,608		4.1
		Cond	0		0		0	0.00		0	0.00		0	0		0.0
	Wall		72,716			07	0	0.00		0	0.00		0	0		0.0
	Parti		-5,411	24,57	1		,293	15.58		72,716	16.75		24,832	-167,314		50.84
		ed Floor	0			-5	,411	-0.87		-5,411	-1.25		64,928	-64,928		19.73
	•	tration	7,121			_	0	0.00		0	0.00		0	0		0.00
		otal==>	. •	77 20	,		,121	1.14	_	7,8 85	1.82	* -	14,848	-14,848		4.51
	Interna		74,427	37,286	•	111,	,713	17.89	*	75,191	17.32	* -20	04,608	-260,698		79.22
	Light		77 577						*			*				
	• .		73,523	C	J		,523	11.77		73,523	16.93	*	0	0		0.00
	People	T	19,740	_	_		740	3.16		10,810	2.49	*	0	0		0.00
	Misc		266,323	0		266,		42.64	* 2	66,323	61.34	*	0	0		0.00
		otal==>	359,585	O	•	359,	585	57.57	* 3	50,655	80.76	*	0	0		0.00
	Ceiling		4,319	-4,319)		0	0.00	*	3,459	0.80	* .	5,209	0		0.00
-	Outside		0.	0	0	. 60,	882	9.75	*	0	0.00	*	0	-126,942	:	38.58
	Sup. Far					90,	495	14.49	*		0.00	*		90,495	-;	27.50
	Ret. Far			0			0	0.00	*		0.00	*		0		0.00
	Duct Hea	•		0			0	0.00	*		0.00	*		0		0.00
	OV/UNDR	-	4,876			4,	876	0.78	*	4,876	1.12	* -3	5,774	-35,774		10.87
	Exhaust			-2,988	0	-2,	988	-0.48	*		0.00	* ·		3,851		-1.17
	Terminal	Bypass		0	0		0	-0.00	*		0.00	k .		Ō		0.00
									ŕ		•	t				
	Grand To	tal==>	443,207	29,979	0	624,	563	100.00	* 43	54,181	100.00	-24	5,591	-329,069	10	00.00
					LING COIL S	ELECTION.										
		Total			Coil Airfl			DB/WB/H		aving D		Gross	AR		 	
		(Tons)	(Mbh)	(Mbh)	(cfm)			Grains		-	Grains			Glass (st	1)	(%)
	Main Clg	52.0	624.6	622.4	39,460	74.8	57.0		-			Floor	12,065			
	Aux Clg	0.0	0.0	0.0	0	0.0	0.0				52.5	Part	15,624			
	Opt Vent	0.0	0.0	0.0	0	0.0	0.0				0.0	ExFlr	0			
	Totals	52.0	624.6	***	•	0.0	0.0	0.0	0.0	0.0	0.0	Roof	4,235		0	0
												Wall	7,884		0	0
		HEATING	COIL SELE	CTION			AIRFL	OWS (cfm	1)	F	NGINEERING	CHECKS-:-	TE	MPERATURES		
		Capacity	Coil Ai	rfl Ent	Lvg	Туре		oling	Heating		% OA	7.0				
		(Mbh)	(cfm) Deg F	Deg F	Vent		2,762	2,76	_	Cfm/Sqft			_		Htg
	Main Htg	-420.2	39,46	_	78.5	Infil		323	32	_	Cfm/Ton	3.27 758.16		60.5		78.5
	Aux Htg	0.0	-	0.0	0.0	Supply	3	9,460	39,46		Sqft/Ton					70.4
	Preheat	-0.0	39,46			Mincfm	,	0	•	_		231.81				70.5
	Reheat	0.0	•	0 0.0		Return	7	9,460		_	Btuh/Sqft					67.3
	Humidif	0.0		0.0		Exhaust		2,762	39,460		People	47				72.0
	Opt Vent	0.0		0 0.0		Rm Exh	,	-	2,76	_	% OA	7.0				0.0
	Total	-420.2		- 0.0		Auxil		0	(Cfm/SqFt	3.27		dTD 0.6		0.0
						MUXIL		0	•) Hta	Btuh/SqFt	-34.83	Fn Fr	ict 1.8		0.0

Block

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DOUBLE DUCT

System

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3

Peaked at Time ==> Mo/Hr: 7/16 Mo/Hr: 7/16 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 OADR: 97 OADB: 24 Space Ret. Air Ret. Air Net Percnt Space Percnt * Space Peak Coil Peak Percnt Sens.+Lat. Sensible Latent Total Of Tot Sensible Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr 0 0 0 0.00 0 0.00 0 O 0.00 Skylite Cond 0 0 0 0.00 0 0.00 0 Ω 0.00 Roof Cond 0 41.022 41,022 2.65 0.00 n O -43,963 5.50 Glass Solar 14,028 n 14,028 0.91 40,581 4.51 0.00 Glass Cond 8,239 0 8,239 0.53 5,819 0.65 -16,967 -16,967 2.12 Wall Cond 147,401 52,964 200,366 12.94 135,487 15.06 -266,726 -361,665 45.23 **Partition** -12,991 -12,991 -0.84 -12,991 -1.44 -149,871 -149,871 18.74 Exposed Floor n 0 0.00 0 0.00 0 0.00 Infiltration 20,007 20,007 1.29 2.57 23,124 -45,361 -45,361 5.67 Sub Total ==> 176,683 93,986 270,670 17.48 192,019 21.34 -478,926 -617,828 77.27 Internal Loads Lights 238,645 ß 238,645 15.41 238,645 26.52 * 0 0 0.00 People 64,680 64,680 4.18 3.94 35,420 0 0.00 0 Misc 425,318 0 425,318 27.47 425,318 47.27 3,208 3,208 -0.40 Sub Total ==> 728,643 0 728,643 47.06 699,382 77.72 3,208 3,208 -0.40Ceiling Load 7,657 -7,657 7,258 0 0.00 0.81 -11,689 0 0.00 Outside Air 0 0 0 189,859 12.26 0.00 -430,464 53.84 Sup. Fan Heat 363,958 23.51 0.00 363,958 -45.52 Ret. Fan Heat 0 0 0.00 0.00 0 0.00 Duct Heat Pkup 0 0 0.00 0.00 0 0.00 OV/UNDR Sizing 1,182 1,182 0.08 1,182 0.13 -127,578 -127,578 15.96 Exhaust Heat -5,903 -5,903 0 -0.380.00 9,137 -1.14 Terminal Bypass 0 0 n -0.00 0.00 0.00 Grand Total==> 914,165 80,427 1,548,408 100.00 * 899,842 100.00 -614,985 -799,567 100.00 ------COOLING COIL SELECTION----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR **Gross Total** Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 36,710 Main Clg 129.0 1,548.4 1,560.1 133,808 74.4 57.5 55.1 62.1 53.0 55.3 41,631 Part Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Exflr 0 Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 13,521 0 Totals 129.0 1,548.4 Wall 17,879 501 3 -----HEATING COIL SELECTION----------AIRFLOWS (cfm)-------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Lvg Type Cool ing Clg % OA **Heating** 7.0 Type Clg fitg (Mbh) (cfm) Deg F Deg F Vent 9,366 9,366 Clg Cfm/Sqft 3.64 SADB 65.0 76.8 -1,219.0 Main Htg 133,808 67.3 76.8 Infil 987 987 Clg Cfm/Ton 1037.00 Plenum 72.7 70.9 Aux Htg 0.0 0 0.0 0.0 Supply 133,808 133,808 Clg Sqft/Ton 284.50 71.0 Return 72.7 **Preheat** -0.0 133,808 67.7 62.1 Clg Btuh/Sqft Mincfm 0 42.18 Ret/OA 74.4 67.7 Reheat 0.0 0 0.0 0.0 Return 133,808 133,808 No. People 154 Runarnd 72.0 72.0 Humidif -439.3 10,353 4.7 75.1 Exhaust 9,366 9,366 Htg % OA 7.0 Fn MtrTD 0.9 0.0 Opt Vent 0.0 0 0.0 0.0 Rm Exh 0 0 Htg Cfm/SqFt 3.64 Fn BldTD 0.7 0.0 Total -1,658.3 Auxil Htg Btuh/SqFt -33.21 Fn Frict 2.1 0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 300

------ BUILDING U-VALUES------

							_				_	_	
										Room	Room		
0	ė	•		Cimmo	Wintr	u/nr/sq		Wintr			Mass (lb/	Capac. (Btu/	
Room Number	Description	Doct	ExFlr	Summr Skylt	Skylt	Poof	Summr Windo		Ual I	Ceil.	sqft)	sqft/F)	
Runber	Description	rait.	EXF	SKYLL	Skytt	KOOI	WITE	WIINGO	watt	cert.	aqı cy	5q1 (717	
1	Z1-BSMT EAST	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30	
Zone	1 Total/Ave.	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30	
2	Z1-1ST FLR EAST	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20	
Zone	2 Total/Ave.	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20	
3	Z2-1ST FLR EAST	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07	
Zone	3 Total/Ave.	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07	
4	Z1-2ND FLR EAST	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70	
Zone	4 Total/Ave.	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70	
5	Z2-2ND FLR EAST	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83	
Zone	5 Total/Ave.	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83	
System	1 Total/Ave.	0.393	0.000	0.000	0.000	0.070	0.000	0.000	0.448	0.317	148.3	29.43	
6	Z1-BSNT WEST	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60	
Zone	6 Total/Ave.	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60	
	Z2-BSMT WEST	0.745	0.000	0.000	0.000	0.000	0.000	0.000		0.317	403.3	79.96	
Zone	7 Total/Ave.	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	96	
8	Z1-1ST FLR WEST	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22	
Zone	8 Total/Ave.	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22	
9	Z2-1ST FLR WEST	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73	
Zone	9 Total/Ave.	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73	
10	Z1-2ND FLR WEST	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16	
Zone	10 Total/Ave.	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16	
11	Z2-2ND FLR WEST	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41	
Zone	11 Total/Ave.	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41	
System	2 Total/Ave.	0.472	0.000	0.000	0.000	0.070	0.000	0.000	0.446	0.317	152.2	30.37	
12	Z3-BSMT SOUTH	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77	
Zone	12 Total/Ave.	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77	
13	Z2-BSMT SOUTH	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34	
Zone	13 Total/Ave.	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34	
14	Z1-BSMT SOUTH	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10	
Zone	14 Total/Ave.	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10	
15	Z1-1ST FLR SOUTH	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97	
Zone	15 Total/Ave.	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97	
. 16	Z2-1ST FLR SOUTH	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96	
Zone	16 Total/Ave.	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96	
17	Z3-1ST FLR SOUTH	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82	
Zone	17 Total/Ave.	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82	
18	Z3-2ND FLR SOUTH	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09	
Zone	18 Total/Ave.	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09	
19	Z1-2ND FLR SOUTH	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94	
Zone	19 Total/Ave.	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94	
20	Z2-2ND FLR SOUTH	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16	
Zone	20 Total/Ave.	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16	
System	3 Total/Ave.	0.417	0.000	0.000	0.000	0.070	0.653	0.706	0.437		129.1	25.81	
Buildin	g	0.423	0.000	0.000	0.000	0.070	0.653	0.706	0.442	0.317	137.5	27.43	

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 300

				Floor	Total		Exposed						
		Numb	er of	Area/Dupl	Floor	Partition	Floor	Skylight	Skl	Net Roof	Window	Win	Net Wall
Room			icate	Room	Area	Area	Area	Area	_	Area	Area	/Wl	
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)		(sqft)	(sqft)		(sqft)
1	Z1-BSAST 1	1		3,595	3,595	8,458	0	0 0		0	0 0		247
Zone	1 Total/Ave.				3,595	8,458	0	0	0	0	0	0	247
2	Z1-1ST FLR EAST	1	1	1,595	1,595	2,145	0	0	0	0	0	0	1,368
Zone	2 Total/Ave.				1,595	2,145	0	0	0	0	0	0	1,368
3	Z2-1ST FLR EAST	1	1	2,640	2,640	858	0	0	0	0	0	0	2,574
Zone	3 Total/Ave.				2,640	8 58	0	0	0	0	0	0	2,574
4	Z1-2ND FLR EAST	1	1	1,595	1,595	3,045	0	0	0	1,595	0	0	1,368
Zone	4 Total/Ave.				1,595	3,045	0	0	0	1,595	0	0	1,368
5	Z2-2ND FLR EAST	1	1	2,640	2,640	2,748	0	0	0	2,640	0	0	2,574
Zone	5 Total/Ave.				2,640	2,748	0	0	0	2,640	0	0	2,574
System	1 Total/Ave.				12,065	17,254	0	0	0	4,235	0	0	8,132
6	Z1-BSMT WEST	1	1	3,280	3,280	5,763	0	0	0	0	0	0	Ō
Zone	6 Total/Ave.				3,280	5,763	0	0	0	0	0	0	0
7	Z2-BSMT WEST	1	1	315	315	909	0	0	0	0	0	0	0
Zone	7 Total/Ave.				315	909	0	0	0	0	0	0	0
8	Z1-1ST FLR WEST	1	1	1,595	1,595	2,784	0	0	0	0	0	0	1,368
Zone	8 Total/Ave.				1,595	2,784	0	0	0	0	0	0	1,368
9	Z2-1ST FLR WEST	1	1	2,640	2,640	1,080	0	0	0	0	0	0	2,574
Zone	9 Total/Ave.				2,640	1,080	0	0	0	0	0	0	2,574
10	Z1-2ND FLR WEST	1	1	1,595	1,595	2,565	0	0	0	1,595	0	0	1,368
Zone	10 Total/Ave.				1,595	2,565	0	0	0	1,595	0	0	1,368
11	Z2-2ND FLR WEST	1	1	2,640	2,640	2,523	0	0	0	2,640	0	0	2,574
Zone	<pre>11 Total/Ave.</pre>				2,640	2,523	0	0	0	2,640	0	0	2,574
System	2 Total/Ave.				12,065	15,624	0	0	0	4,235	0	0	7,884
12	Z3-BSMT SOUTH	1	1	2,202	2,202	6,539	0	0	0	0	0	0	0
Zone	12 Total/Ave.				2,202	6,539	0	0	0	0	0	0	0
13	Z2-BSMT SOUTH	1	1	3,780	3,780	9,473	0	0	0	0	0	0	0
Zone	13 Total/Ave.				3,780	9,473	0	0	0	0	0	0	0
14	Z1-BSMT SOUTH	1	1	3,685	3,685	8,091	0	0	0	0	0	0	49
Zone	14 Total/Ave.				3,685	8,091	0	0	0	0	0	0	49
	Z1-1ST FLR SOUTH	1	1	4,089	4,089	6,168	0	0		0	0 0		2,628
Zone	15 Total/Ave.				4,089	6,168	0	0	0	0	0	0	2,628
	Z2-1ST FLR SOUTH	1	1	6,002	6,002	2,415	0	0	0	0	501	14	3,171
Zone	16 Total/Ave.				6,002	2,415	0	0	0	0	501	14	3,171
		1	1	3,430	3,430	2,352	0	0	0	0	0	0	2,475
Zone	17 Total/Ave.				3,430	2,352	0	0	0	. 0	0	0	2,475
	Z3-2ND FLR SOUTH	1	1	5,763	5,763	3,444	0	0	0	5,763	0	0	3,348
Zone	18 Total/Ave.				5,763	3,444	0	0	0	5,763	0	0	3,348
	Z1-2ND FLR SOUTH	1	1	2,077	2,077	930	0	0	0	2,077	0	0	2,313
Zone	19 Total/Ave.				2,077	930	0	0	0	2,077	0	0	2,313
	Z2-2ND FLR SOUTH	1	1	5,681	5,681	2,220	0	0	0	5,681	0	0	3,393
Zone	20 Total/Ave.				5,681	2,220	0	0	0	5,681	0	0	3,393
System	<pre>3 Total/Ave.</pre>				36,710	41,631	0	0	0	13,521	501	3	17,378
Building					60,840	74,509	0	0	0	21,991	501	1	33,393

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1
BASELINE BUILDING 300

System Totals

Percent	Cool	ing Loa	nd	Keati	ng Load		Cooling	Airflo	w	Heating	Airflo	u
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours		Cap.		Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	11.0	0	0	-120,956	22	946	10,985.4	0	0	0.0	0	0
5 - 10	22.0	0	0	-241,912	19	817	21,970.8	0	0	0.0	0	0
10 - 15	33.1	0	0	-362,869	15	659	32,956.2	0	0	0.0	0	0
15 - 20	44.1	10	872	-483,825	12	519	43,941.6	0	0	0.0	0	0
20 - 25	55.1	17	1,491	-604,781	13	556	54,927.0	0	0	0.0	0	0
25 - 30	66.1	12	1,025	-725 ,7 37	8	364	65,912.4	0	0	0.0	0	0
30 - 35	77.2	7	624	-846,693	6	238	76,897.8	0	0	0.0	0	0
35 - 40	88.2	9	801	-967,650	5	218	87,883.2	0	0	0.0	0	0
40 - 45	99.2	5	448	-1,088,606	0	0	98,868.6	0	0	0.0	0	0
45 - 50	110.2	8	730	-1,209,562	0	0	109,854.0	0	0	0.0	0	0
50 - 55	121.2	7	593	-1,330,518	0	0	120,839.4	0	0	0.0	0	0
55 - 60	132.3	5	427	-1,451,474	0	0	131,824.8	0	0	0.0	0	0
60 - 65	143.3	5	438	-1,572,431	0	0	142,810.2	0	0	0.0	0	0
65 - 70	154.3	5	432	-1,693,387	0	0	153,795.6	0	0	0.0	0	0
70 - 75	165.3	3	235	-1,814,343	0	0	164,781.0	0	0	0.0	0	0
75 - 80	176.4	2	212	-1,935,299	0	0	175,766.4	0	0	0.0	0	o
80 - 85	187.4	2	154	-2,056,255	0	0	186,751.8	0	0	0.0	0	0
85 - 90	198.4	2	150	-2,177,211	0	0	197,737.2	0	0	0.0	0	0
90 - 95	209.4	1	108	-2,298,168	0	0	208,722.6	0	0	0.0	0	0
95 - 100	220.4	0	20	-2,419,124	0	0	219,708.0	100	8,760	0.0	0	0
Hours Off	0.0	0	0	0	0	4,443	0.0	0	. 0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 WASTE HEAT RECOVERY : P300

 М	0	N	1	Н	L	Υ	Ε	N	Ε	R	G	Y	С	0	N	S	U	М	Ρ	T	1	0	N	

	ELEC	DEMAND	GAS		GAS DMND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(kWh)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)
Jan	368,708	674	720	58	5
Feb	334,316	674	431	63	4
March	377,302	674	0	149	0
April	367,838	698	0	222	0
May	395,164	721	0	321	0
June	396,753	740	0	381	0
July	412,540	750	0	416	0
Aug	414,839	744	0	403	0
Sept	381,228	722	0	317	0
0ct	385,657	706	0	241	0
Nov	362,310	674	0	137	0
Dec	368,714	680	94	80	2
Total	4,565,370	750	1,245	2,788	5

Building Energy Consumption = 258,153 (Btu/Sq Ft/Year)
Source Energy Consumption = 258,216 (Btu/Sq Ft/Year)

Floor Area = 60,840 (Sq Ft)

Emonthly KW = 3-57

------ UTILITY PEAK CHECKSUMS-----

Utility ELECTRIC DEMAND

Peak Value 749.9 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eco.			Utility	Percnt	
Ref.	Equipment		Demand	Of Tot	
Num.	Code Name	Equipment Description	(kW)	(%)	
Cooling	Equipment				
1	EQ1070L	WTR-CLD RECIP >30 TONS	85.1	11.35	
2	EQ1001S	2-STG CTV <555 TONS	118.0	15.74	
Sub Total	l		203.2	27.09	
Sub Total	L		0.0	0.00	
Air Movi	ng Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	48.5	6.47	
2		SUMMATION OF FAN ELECTRICAL DEMAND	33.6	4.48	
3		SUMMATION OF FAN ELECTRICAL DEMAND	119.4	15.92	
Sub Total	L		201.4	26.86	
Sub Total	l		0.0	0.00	
Miscellar	neous				
Lights			109.1	14.55	
Base Uti	ilities		0.0	0.00	
Misc Equ	•		236.2	31.49	
Sub Total	l		345.3	46.05	
Grand Tot	tal		749.9	100.00	

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

							•	
		LOCATION: Whit	e Sands Missil	le Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	BLDG. 300 -	DRY-BULB ECONOMIZE	ERS WITH DDC CONT	ROLS	FISCAL YEAR:	1992
		DISCRETE PORTIO	ON NAME:	TOTAL				
		ANALYSIS DATE:	07/07/92		ECONOMIC LIFE:	15	PREPARED BY:	A. NIEMEYER
1		VESTMENT						
	A.	CONSTRUCTION	COST	=			\$149,536	
	В.			(5.5% of 1A) =			\$8,224	
		DESIGN COST		(6.0% of 1A) =			\$8,972	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$166,733	
		SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D – 1E) =			 >	\$166,733
	EN	EDOV SAVINOS (.)	(COST ()					
2	SIA	IERGY SAVINGS (+) FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
		FUELTIFE	\$/MBTU (1)				DISCOUNTED	
	Α	ELEC	\$6.48	MBTU/YR (2) 1,346	SAVINGS (3)	FACTOR (4) 10,79	SAVINGS (5)	
		DIST	40.40	1,340	\$8,714 \$0	10.79	\$94,026 \$0	
		NAT GAS	\$2.21	(2,144)		12.38	(\$58,723)	
		PAPER	42.21	(2,144)	(\$4,743) \$0	12.36	(\$56,723) \$ 0	
		COAL		V	\$0	11.35	\$0	
		TOTAL		(798)		11.55	>	\$35,303
	••	TOTAL		(186)	3,870.0			435,303
3	NO	N-ENERGY SAVIN	GS (+) / COST	(-)				
				CT. DEMAND SAVINGS)	=		\$7,198	
		1 DISCOUNT FAC		,	(From Table A-2) =	10.67	***	
		2 DISCOUNTED S	AVINGS (+) / C	COST (-)	(3A x 3A1) =		\$76,776	
	B.	NON-RECURRING	3 (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENE	RGY DISCOU	NTED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$76,776
	D.	PROJECT NON-E	NERGY TEST					
		1 25% MAXIMUM	NON-ENERG	Y CALCULATION		(2F5 x 0.33) =	\$11,650	
		a IF 3D1 => 3C 1	THEN GO TO 4	1				
		b IF 3D1 < 3C TH	HEN CALCULA	ATE SIR		(2F5 + 3D1) / 1F =	0.28	
		c IF 3D1b => 1 T	HEN GO TO 4	1				
		d F 3D1b < 1 Th	IEN PROJECT	DOES NOT QUALIFY				
4	EIE	RST YEAR DOLLAR	SAVINGS	COSTS (-)	(050	. 0A . (0D4-1/05)		***
		TAL NET DISCOUN		• •	(2F3	+ 3A + (3B1d/25)) =		\$11,166
				TMENT RATIO (SIR)		(2F5 + 3C) =		\$112,079
J		F SIR < 1 THEN PRO		• •		(5/1F) =		0.67
7		MPLE PAYBACK (SF		HOT GUNLIFT)		/1E/A\ -		14.00
•	JII/	LL I ATDAOK (SP	J ,			(1F/4) ≃		14.93

)						
	CONSTRUCTION COST ESTIMATE BREAKDOWN	: BREAKD(NWC							
CONTRACTOR	TOR EMC ENGINEERS INC.			ADDRESS 2750 SOU	JTH WADSW	ORTH BLVI	D., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	O 80227	
CONTINAC	CONTRACT FOR (WORK to be performed) DRY-BULB ECONOMIZERS ON AHUS with DDC CONTROLS	DDC CON	۱ ۱	BLDG. 300			PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
				MATERIAL COST	L COST		LABOR COSTS			
Line		Cuit	Quantity			Manhours	Average		Other	Line
Š.		Measure	. 6	Cuit	Total	Mandays	Rate	Total	Costs	Total
	RETURN AIR, OUTSIDE AIR, & MIXED AIR SENSORS	<u> </u>	13	164.00	2132	1.80	27.60	645.84	(6)	\$2,777.84
	CONSTANT AVG. DUCT TEMP. SENSOR	EA	9	200.20	1201.2	2.00	27.60	331.20		\$1,532.40
	SPACE TEMPERATURE SENSORS	EA	20	153.00	3060.00	1.50	27.60	828.00		\$3,888.00
	DIFF. PRESSURE SWITCH - AIR	EA	6	38.80	232.80	0.50	27.60	82.80		\$315.60
D10-3	E / P TRANSDUCERS	EA	12	87.5	1050.00	1	27.60	331.20		\$1,381.20
,	PNEUMATIC TUBING	LF	200	0.70	140.00	60.0	35.81	651.74		\$791.74
	CONDUIT - 3/4" EMT w/ WIRE	LF	1500	0.48	715.5	90.0	27.60	2566.80		\$3,282.30
	PROGRAMMABLE LOGIC CONTROLLER	EA	6	270.00	1620.00	2.0	27.60	331.20		\$1,951.20
	CONTROL RELAY BASE / HOA	EA	9	51.20	307.20	2.0	27.60	331.20		\$638.40
	REMOTE CONTROL UNIT	EA	9	1125	6750.00	8.0	27.60	1324.80		\$8,074.80
	HAND-HELD TERMINAL	EA	1	1750	1750.00	1.5	50.00	75.00		\$1,825.00
	CONTROL PROGRAMMING	EA	3			6.0	50.00	900.00	•	\$900.00
	FIELD TEST OF CONTROL SYSTEM	EA	ဗ			6.0	27.60	496.80		\$496.80
	REFURBISH DAMPERS & DAMPER ACTUATOR	EA	9	75	450.00	4	35.81	859.44		\$1,309.44
	SUBTOTAL THIS SHEET									\$29,164.72
	Source: Means Electrical, Mechanical, & Construction Cost Data, 1892: Material Prices Include 25% Overhead & Profit: Labor Source: U.S. Dent. of Labor. General Wane Decision No. NM91-1	sterial Prices Inclin	le 25% Overhead	& Profit- Labor 8	Course: 11.8 Dent of	lahor General Wad	Purchalon No Number	1-1		

Source: Means Electrical, Mechanical, & Construction Cost Date, 1982; Material Prices Include 25% Overhead & Profit, Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1

<u> </u>		CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKD	NWC							
10	CONTRACTOR				ADDRESS	i i					
		EMC ENGINEERS INC.			2750 SO(2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO	ORTH BLW	o., #C-200,	DENVER, C	0 80227	
<u> </u>	CONTRACT F	CONTRACT FOR (Work to be performed) DRY-BULB ECONOMIZERS ON AHUS with DDC CONTR	IDC CON	FROLS - B	OLS - BLDG. 300			PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
<u> </u>	PURCHASE R	PURCHASE REQUEST NUMBER	. :		PROJECT NUMBER	BER		WHITE SAN	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
					MATERIAL COST	L COST		LABOR COSTS			
	Line	Item	Chit	Quantity		ļ	Manhours	Average		Other Direct	Line
	NO.	(1)	Measure (2)	(3)	(4) (5)	l otal (5)	Mandays (6)	Rate (7)	Total (8)	Costs (9)	Total (10)
		DEMOLITION									
		REMOVE CONCRETE BLOCK AND BRICK WALL	R	384	2.55	979.20	0.69	20.58	5425.22		\$6,404.42
		DISPOSAL OF CONSTRUCTION DEBRIS	≿	14.4	14.88	214.20	1.14	20.58	337.10		\$551.30
_ '		REMOVE DUCTWORK	Ą	က			11.88	20.58	733.16		\$733.16
10-4		ROOF OPENING	A	83	2.625	165.38	0.2	20.58	259.31		\$424.68
		NEW HVAC DUCTWORK AND DAMPERS									
1		GALVANIZED STEEL DUCTWORK	LBS	10800	0.66	7155	0.10	27.63	29430.09		\$36,585.09
		RELIEF AIR VENT ON ROOF	Æ	က	9100	27300.00	28.1	27.63	2331.28		\$29,631.28
		DAMPERS W/ ACTUATOR (RA & EXH. AIR)	Æ	9	625.0	3750.00	4.0	27.63	667.47		\$4,417.47
I		O.A. LOUVER, DAMPER W/ ACTUATOR	ς. Υ	384	56.5	21705.60	0.4	27.63	4668.36		\$26,373.96
		CURB	۳	54	1.39	74.93	9.0	27.63	65.28		\$140.20
		CUTTING, PATCHING, BRACING, DUST PROTECTION, MISC.	EA	-	1680.0	1680.00	90.00	27.63	2486.70		\$4,166.70
		CONTINGENCY (10%)									\$10,943
		SUBTOTAL									\$120,371
		TOTAL									\$149,536
		Source: Meane Bectirkal, Mechanical, & Construction Cost Date, 1992; Material Prices Include 25% Overhead & Profit: Labor Source: U.S. Dent. of Labor. General Wane Decision No. NM91-1	erial Prices Inclus	te 25% Overhead	& Profit: Labor 8	Source: U.S. Dept. of I	abor. General Wag	Decision No NW9	21-1		

Source: Means Electrical, Mechanical, & Construction Cost Date, 1992; Material Prices Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1

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Trane Air Conditioning Economics

By: Trane Customer Direct Service Network
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> ESOS STUDY AT WSMR - BUILDING 300 WHITE SANDS MISSILE RANGE NM US ARMY

and design

EMC ENGINEERS, INC.
RANGE CONTROL BLDG: ALT 1-BSLN, ALTZ-ECO (ECONOMIZERS W/ DISCRIMINATOR CONTROLS)

ELPASO.W Weather File Code: Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) 6 Time Zone: 3,918 (ft) Elevation: Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 98 (F) Summer Design Dry Bulb: Summer Design Wet Bulb: 64 (F) 24 (F) Winter Design Dry Bulb: 0.20 Summer Ground Relectance:

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)

Winter Ground Relectance:

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

0.20

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 22:11:59 6/18/92

Dataset Name: 300EC .TM

artististist.

System 1 Block DD - DOUBLE DUCT

		Mo/Hr: 13,				Mo/H					710	lo/Hr: 7		11me ==>	Peaked at
	4	OADB: 2		*	: 97	QAD	*			0	77/ 64/ 49.0	18/HR: 9	OADBA	ir ==>	Outside A
Perci	eak	ak Coil P	Space Pea	Percnt *	2	Spa	*	Percr	Net		Ret. Air	et. Air	Space		
Of To	ens	ns Tot S	Space Sen	Of Tot *		Sensib		Of To	otal		Latent	ensible	s.+Lat.	Ser	
C	uh)	h) (Bt	(Btuh	(%) *)	(Btu		(2	tuh)		(Btuh)	(Btuh)	(Btuh)		Envelope
0.0	0	0		0.00 *	0			0.0	0	•	\-	0	0		Skylite
0.0	0	0		0.00 *	0		*	0.0	0			0	0		Skylite
3.5	550	0 -13,		0.00 *	0		*	2.7	,734	12.		12,734	0		Roof Co
0.0	0	0		0.00 *	0		*	0.0	. 0	•		0	0		Glass S
0.0	0	0		0.00 *	0		*	0.0	0			0	0		Glass C
45.4	237	69 -173,	-128,96	28.85 *	7	81,1	*	23.0	,917	108,		27,781	81,136		Wall Co
15.7	134	34 -60,	-60,13	-1.77 *	5	-4,9	*	-1.0	,965				-4,965		Partiti
0.0	0	0		0.00 *	0		*	0.0	. 0	•			0		Exposed
3.9	848	48 -14,	-14,84	2.80 *	5	7,8	*	1.3	, 185	6.			6,185		Infiltr
68.6	770	52 -261,	-203,95	29.88 *		84,0		26.0		122,		40,515	82,355		Sub Tot
			•	*			*		,	,,,,		40,515	02,333		nternal
0.0	0	0		21.46 *	1	60,3	•	12.7	,341	60.		0	60,341	Luaus	Lights
0.0	0	0		5.32 *		14,9	*		,300	•		·	27,300		-
0.0	0	0		36.94 *		103,8		21.9	,877	-	0	0	103,877		People Misc
0.0	0	0		63.71 *		179,1		40.5	,518	•	0	0	191,518		
0.0	0	28	-4,62	1.15 *		3,2		0.0	0	171,	Ū	-3,991	=		Sub Tot
39.2	417	0 -149,	-	0.00 *	3	-,-		13.1	,240	62	0	-3,771	3,991 0		eiling L
-22.1		84,		0.00 *				17.8	,211	•	Ū	·			utside A
0.0	0	•		0.00 *			*		,	04,		0			up. Fan et. Fan
0.0	0			0.00 *			*		0			0			uct Heat
15.2	220	20 -58,	-58,22	5.25 *	3	14,7		3.1	,770	14		·	14,770		V/UNDR S
-1.0	116	-	·	0.00 *	_	, ,		-0.6	,250		0	-3,250	14,770		xhaust H
0.0	0			0.00 *				-0.0	0	-,	0	0,230			erminal
				*			*		•		•	•		o,pass	CI III II II C
100.0	080	799 -381,	-266,79	100.00 *	5	281,2	*	100.0	,359	472,	0	33,274	292,634	al==>	rand Tot
		AREAS							N	FLECTION	.ING COIL SE				
) (%	s (sf		Gross Tota	WB/HR	g DB/	Leavi	/HR	g DB/W			Coil Airfl		pacity Se	Total Ca	
		12,065	Floor 1	Grains	g F	Deg F D	ins	F Gr	Deg	Deg F	(cfm)	Mbh)	(Mbh)	(Tons)	
		17,254	Part 1	57.3	4.1	63.8	6.8	.0	58	74.7	46,440	478.2	472.4	39.4	in Clg
		0	Exflr	0.0	0.0	0.0	0.0	.0	0	0.0	0	0.0	0.0	0.0	x Clg
0		4,235	Roof	0.0	0.0	0.0	0.0	.0	0	0.0	0	0.0	0.0	0.0	t Vent
0		8,132	Wall										472.4	39.4	tals
(F)-	TURES	TEMPERA	CHECKS	GINEERING	EN		cfm)-	FLOWS	AIR			ON	COIL SELECT	HEATING	
Hts	Clg	Туре	7.0	% OA	Clg	ating		Coolin		Туре	Lvg		Coil Airf	Capacity	
78.	65.7	SADB	3.85	Cfm/Sqft		3,251		3,25		Vent	Deg F	Deg F	(cfm)	(Mbh)	
70.	73.0	Plenum	1179.78	Cfm/Ton	Clg	323		32		Infil	78.0	70.3	46,440	-340.6	in #tg
70.	73.0	Return	306.51	Sqft/Ton		46,440		46,44		Supply	0.0	0.0	10,110	0.0	c Htg
	74.7	Ret/QA		Btuh/Sqft	_	0		-		Mincfm	63.8	67.4	46,440	-0.0	heat
72.	72.0	Runarnd	65	People	-	46,440		46,44		Return	0.0	0.0	0,110	0.0	neat
	0.6	Fn MtrTD	7.0	-	Htg	3,251		3,25		Exhaust	0.0	0.0	Ò	0.0	nidif
	0.5	Fn BldTD	3.85	Cfm/SqFt		0		-	-	Rm Exh	0.0	0.0	Č	0.0	t Vent
						-				6711	~.0	0.0		0.0	- 4-111

satistic control of

- DOUBLE DUCT 2 Block DD System

	EAK *	Mo/Hr: 13	M	*	7/16	'Hr: 7	Mod	*				7/16	4o/Hr: 7		+ Tima	Doobod -
		OADB: 2		*		DB: 9		*			n	77 64/ 49.0		0400	t Time ==>	
	•			*	•	wo. ,	O,	*			,	77 047 47. 0	NB/NK: Y	UADE	41r ==>	Outside /
Percn	eak	k Coil P	Space Peak	*	Percnt	ace	Sr	*	Percnt	Net		Ret. Air	Pot Air	Space		
Of To	ens		Space Sens		Of Tot		Sensi		Of Tot			Latent	Sensible	ns.+Lat.		
(%)	uh)		(Btuh)		(%)	:uh)			(%)	tuh)		(Btuh)	(Btuh)	(Btuh)		Envelope
0.0	0		0		0.00	0	,,,,		0.00	0	(5)	(BtGit)	0	0		Skylite
0.0	0		0		0.00	0			0.00	0			0	0		•
4.1	_		0		0.00	0			2.03	,709	12			0		Skylite
0.0	0	•	0		0.00	0			0.00	0	14,		12,709 0			Roof Co
0.0	0	_	0		0.00	0				_				0		Glass
50.84						-	77		0.00	0			0	0		Glass (
		-	-124,832		16.75	716	-		15.58	,293	•		24,577	72,716		Wall Co
19.7		=	-64,928		-1.25	411	-5,		-0.87	,411	-5,			-5,411	ion	Partiti
0.0	0	-	0		0.00	0			0.00	0				0	d Floor	Exposed
4.5			-14,848		1.82	885			1.14	,121	•			7,121	ration	Infilt
79.2	698	8 -260,	-204,608	*	17.32	191	75,	*	17.89	,713	111,		37,286	74,427	tal==>	Sub To
				*				*							Loads	Internal
0.0	0	0	0	*	16.93	523	73,	*	11.77	,523	73,		0	73,523		Lights
0.0	0	0	0	*	2.49	810	10,	*	3.16	,740	19,			19,740		People
0.0	0	0	0	*	61.34	323	266	*	42.64	,323	266,	0	0	266,323		Misc
0.0	0	0	0	*	80.76	655	350,	*	57.57	,585	359,	0	0	359,585	tal==>	Sub To
0.0	0	19	-5,209	*	0.80	459	3,	*	0.00	0			-4,319	4,319	Load	Ceiling
38.5	942	0 -126,	0	*	0.00	0		*	9.75	,882	60,	0	0	. 0		Outside /
-27.5	495	90,		*	0.00			*	14.49	,495	90,					Sup. Fan
0.0	0			*	0.00			*	0.00	0			0			Ret. Fan
0.0	0			*	0.00			*	0.00	0			0			Duct Heat
10.8	774	4 -35,	-35,774	*	1.12	876	4.		0.78	,876	4.		_	4,876	-	OV/UNDR S
-1.1	851		•		0.00				-0.48	.988	-	0	-2,988	1,2.0	_	Exhaust I
0.0	C	·			0.00				-0.00	0	-•	0	0			Terminal
				*				*	••••			•	•		Б уразэ	TCT III TRACE
100.0	069	1 -329,	-245,591	*	100.00	181	434	*	100.00	,563	624,	0	29,979	443,207	tal==>	Grand To
		AREAS								N	ELECTION	LING COIL SE	cool			
) (%)	s (sf	il Glas	Gross Total		/WB/HR	ing DB	Leav		g DB/WE			Coil Airfl	ns Cap.	apacity S	Total C	
		2,065	-		Grains	Deg F	Deg F	ins	F Gra	Deg	Deg F	(cfm)	(Mbh)	(Mbh)	(Tons)	
		5,624	Part 15,	ļ	52.5	50.8	58.1	2.4	.0 5	57	74.8	39,460	622.4	624.6	52.0	Main Clg
		0	ExFlr	-	0.0	0.0	0.0	0.0	.0	0	0.0	0	0.0	0.0	0.0	Aux Clg
0 (4,235	•	1	0.0	0.0	0.0	0.0	.0	0	0.0	0	0.0	0.0	0.0	Opt Vent
0 1		7,884	Wall 7,	1										624.6	52.0	Totals
(F)	TURES	TEMPERA	CHECKS	NG	NGINEERI	E		cfm)·	FLOWS (AIR			ION	COIL SELEC	HEATING	
Htg	Clg	Type	7.0		% OA	Clg	leating	1	Cooling		Type	Lvg	l Ent	Coil Air	Capacity	
78.	60.5	SADB	3.27 S	t	Cfm/Sqf	Clg	2,762		2,762		Vent	Deg F	Deg F	(cfm)	(Mbh)	
70.	73.1	Plenum	758.16 P	1	Cfm/Ton	Clg	323		323		Infil	78.5	67.4	39,46	-420.2	Main Htg
70.	73.1	Return	231.81 R	n	Sqft/To	Clg	39,460		39,460	•	Supply	0.0	0.0		0.0	Aux Htg
67.	74.8	Ret/OA	51.77 R	ft	Btuh/Sq	Clg	0		(ì	Mincfm	58.1	67.3		-0.0	Preheat
72.	72.0	Runarnd	47 R		People	No.	39,460		39,460		Return	0.0	0.0	-	0.0	Reheat
0.	0.8	Fn MtrTD	7.0 F		% OA		2,762		2,762		Exhaust	0.0			0.0	Humidif
	0.6	Fn BldTD		t	Cfm/SqF	-	0		(Rm Exh		0.0		0.0	Opt Vent
		Fn Frict			Btuh/Sq	_	0		(Auxil				-420.2	Total

1003200

System 3 Block DD - DOUBLE DUCT

Peaked at	Time ==	>	Mo/Hr:	7/16			*	Mo)/Hr:	7/16	k	Mo/Hr:	13/ 1	
Outside Ai	ir ==>	OA		97/ 64/ 49.	0		*	C	DADB:	97	k	OADB:	24	
		C	Da4 45	r Ret. Air	AI.	et Perc	n+ *		Space	Percnt 1	* Space	Peak Coi	l Peak	Percnt
	c	Space ens.+Lat.	Sensible			al Of 1			ible	Of Tot	•		t Sens	Of Tot
Envelope L		(Btuh)	(Btuh)		(Btu		(%) *		Stuh)	(%)	•		(Btuh)	(%)
Skylite		0) (Bean)	(510		.00 *		0	0.00	-	0	0	0.00
Skylite		0		,)			.00 *		0	0.00		0	0	0.00
Roof Cor		0	41,022		41,0		.65 *		0	0.00		0 -	43,963	5.50
Glass So		14,028	,		14,0		.91 *	40	,581	4.51	+	0	0	0.00
Glass Co		8,239	()	8,2		.53 *	5	,819	0.65	* -16	,967 -	16,967	2.12
Wall Cor		147,401	52,964	•	200,3		94 *		,487	15.06	-266	,726 -3	61,665	45.23
Partitio		-12,991	• .		-12,9		.84 *	-12	,991	-1.44	-149	,871 -1	49,871	18.74
Exposed		0			•		00 *		. 0	0.00		0	0	0.00
Infiltra		20,007			20,0	07 1.	29 *	23	,124	2.57	-45	,361 -	45,361	5.67
Sub Tota		176,683	93,986	3	270,6		48 *		,019	21.34		-	17,828	77.27
Internal L			,,,,,,				*	.,-	•	•	k	-	-	
Lights		238,645	()	238,6	45 15.	41 *	238	,645	26.52	t	0	0	0.00
People		64,680			64,6		18 *		,420	3.94		0	0	0.00
Misc		425,318	(0	425,3		47 *		,318	47.27	• 3	,208	3,208	-0.40
Sub Tota	a(==>	728,643	C		728,64		.06 *	699	,382	77.72	3	,208	3,208	-0.40
Ceiling Lo		7,657	-7,657	,	•		* 00	7	,258	0.81	-11	,689	0	0.00
Outside Ai		. 0.		0	189,8	59 12.	26 *		0	0.00	+	0 -4	30,464	53.84
Sup. Fan H	leat				363,9	58 23.	51 *			0.00	t	3	63,958	-45.52
Ret. Fan H	leat		()		0 0.	00 *			0.00	۲		0	0.00
Duct Heat	Pkup		()		0 0.	00 *			0.00	•		0	0.00
OV/UNDR Si	izing	1,182			1,18	B2 O.	* 80	1	,182	0.13	-127	,578 -1	27,578	15.96
Exhaust He	eat		-5,903	0	-5,9	03 -0.	38 *			0.00	t .		9,137	-1.14
Terminal B	Bypass		C	0		0 -0.	00 *			0.00	٠		0	0.00
							*			•	•			
Grand Tota	(==>	914,165	80,427	0	1,548,40	08 100.	00 *	899	,842	100.00	-614	,985 -7	99,567	100.00
			coc	LING COIL S	ELECTION-							AREA	s	
	Total (Capacity	Sens Cap.	Coil Airfl	Ente	ring DB/	WB/HR	Lea	_	B/WB/HR	Gross T	otal G	lass (s	f) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F [Deg F G	rains	Deg F	Deg F	Grains	Floor	36,710	,	
lain Clg	129.0	1,548.4	1,560.1	133,808	74.4	57.5	55.1	62.1	53.0		Part	41,631		
lux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0		Exflr	0		
opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	13,521		0 0
otals	129.0	1,548.4									Wall	17,879	!	501 3
	-HEATING	G COIL SELE	ECTION		/	AIRFLOWS	(cfm)			ENGINEERING	CHECKS	TEMP	ERATURE:	s (F)
	Capacity	y Coil Ai	irfl Ent	Lvg	Type	Cooli	ng	Heating	Cl	g % OA	7.0	Type	Clg	Htg
	(Mbh)	(cfr	n) Deg F	Deg F	Vent	9,3	66	9,366	Cl	g Cfm/Sqft	3.64	SADB	65.	76.8
lain Htg	-1,219.0	133,8	308 67.3	76.8	Infil	9	87	987	Cl	g Cfm/Ton	1037.00	Plenum	72.	70.9
lux Htg	0.0	0	0 0.0	0.0	Supply	133,8	808	133,808	Cl	g Sqft/Ton	284.50	Return	72.	7 71.0
reheat	-0.0	133,8	308 67.7	62.1	Mincfm		0	0	Cl	g Btuh/Sqf1	42.18	Ret/OA	74.	4 67.7
leheat	0.0	0	0.0	0.0	Return	133,8	808	133,808	No	. People	154	Runarn	d 72.	72.0
lumidif	-439.3	3 10,3	553 4.7	75.1	Exhaust	9,3	66	9,366	Ht	g % OA	7.0	Fn Mtr	TD 0.9	9 0.0
pt Vent	0.0	0	0.0	0.0	Rm Exh		0	0	Ht	g Cfm/SqFt	3.64	Fn Bld	TD 0.	7 0.0
	-1,658.3				Auxil		0	0		g Btuh/SqF1	-33.21	Fn Fri	ct 2.	1 0.0

BUILDING U-VALUES - ALTERNATIVE 3
ECO - ECONOMIZERS ON AHUS - BUILDING 300

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-----BUILDING U-VALUES------

					Roc	om II-Vaİ	lues				Room	Room
						/hr/sqf					Mass	Capac.
Room				Summr	Wintr	., , oq.		Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo		Wall	Ceil.	sqft)	sqft/F)
1	Z1-BSMT EAST	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
Zone	1 Total/Ave.	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
2	Z1-1ST FLR EAST	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
Zone	2 Total/Ave.	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
3	Z2-1ST FLR EAST	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
Zone	3 Total/Ave.	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
4	Z1-2ND FLR EAST	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
Zone	4 Total/Ave.	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
5	Z2-2ND FLR EAST	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
Zone	5 Total/Ave.	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
System	1 Total/Ave.	0.393	0.000	0.000	0.000	0.070	0.000	0.000	0.448	0.317	148.3	29.43
6	Z1-BSMT WEST	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
Zone	6 Total/Ave.	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
. 7	Z2-BSMT WEST	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
Zone	7 Total/Ave.	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
8	Z1-1ST FLR WEST	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
Zone	8 Total/Ave.	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
9	Z2-1ST FLR WEST	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
Zone	9 Total/Ave.	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
10	Z1-2ND FLR WEST	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
Zone	10 Total/Ave.	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
11	Z2-2ND FLR WEST	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
Zone	11 Total/Ave.	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
System	2 Total/Ave.	0.472	0.000	0.000	0.000	0.070	0.000	0.000	0.446	0.317	152.2	30.37
12	Z3-BSMT SOUTH	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
Zone	12 Total/Ave.	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
13	Z2-BSMT SOUTH	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
Zone	13 Total/Ave.	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
14	Z1-BSMT SOUTH	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
Zone	14 Total/Ave.	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
15	Z1-1ST FLR SOUTH	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
Zone	15 Total/Ave.	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
16	Z2-1ST FLR SOUTH	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
Zone	16 Total/Ave.	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
17	Z3-1ST FLR SOUTH	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
Zone	17 Total/Ave.	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
18	Z3-2ND FLR SOUTH	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
Zone	18 Total/Ave.	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
19	Z1-2ND FLR SOUTH	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
Zone	19 Total/Ave.	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
20	Z2-2ND FLR SOUTH	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
Zone	20 Total/Ave.	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
System	3 Total/Ave.	0.417	0.000	0.000	0.000	0.070	0.653	0.706	0.437	0.317	129.1	25.81
Buildin	-	0.423	0.000	0.000	0.000	0.070	0.653		0.442		137.5	27.43
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BUILDING AREAS - ALTERNATIVE 3
ECO - ECONOMIZERS ON AHUS - BUILDING 300

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------ BUILDING AREAS ------

				Floor	Total		Exposed						
		Mumb	er of	Area/Dupt	Floor	Partition	Floor	Skylight	Skl	Net Roof	Window	Uin	Net Wall
Room			icate	Room	Area	Area	Area	Area	/Rf	Area	Area	/WL	Area
Number	Description	Fir	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
				(-4,-,	4-4	4-4	404.00	4-4	••	V= 4: -V	V- 4V		4-4
1	Z1-BSMT EAST	1	1	3,595	3,595	8,458	0	0	. 0	0	0	0	247
Zone	1 Total/Ave.				3,595	8,458	0	0	0	0	0	C	247
2	Z1-1ST FLR EAST	1	1	1,595	1,595	2,145	0	0	0	0	0	0	1,368
Zone	2 Total/Ave.				1,595	2,145	0	0	0	0	0	0	1,368
3	Z2-1ST FLR EAST	1	1	2,640	2,640	858	0	0	0	0	0	0	2,574
Zone	3 Total/Ave.				2,640	858	0	0	0	0	0	0	2,574
4	Z1-2ND FLR EAST	1	1	1,595	1,595	3,045	0	0	0	1,595	0	0	1,368
Zone	4 Total/Ave.				1,595	3,045	0	0	0	1,595	0	0	1,368
5	Z2-2ND FLR EAST	1	1	2,640	2,640	2,748	0	0	0	2,640	0	0	2,574
Zone	5 Total/Ave.				2,640	2,748	0	0	0	2,640	0	0	2,574
System	1 Total/Ave.				12,065	17,254	0	0	0	4,235	0	0	8,132
6	Z1-BSMT WEST	1	1	3,280	3,280	5,763	0	0	0	0	0	0	0
Zone	6 Total/Ave.				3,280	5,763	0	0	0	0	0	0	0
7	Z2-BSMT WEST	1	1	· 315	315	909	0	0	0	0	0	0	0
Zone	7 Total/Ave.				.315	909	0	0	0	0	0	0	0
8	Z1-1ST FLR WEST	1	1	1,595	1,595	2,784	0	0	0	0	0	0	1,368
Zone	8 Total/Ave.				1,595	2,784	0	0	0	0	0	0	1,368
9	Z2-1ST FLR WEST	1	1	2,640	2,640	1,080	0	0	0	0	0	0	2,574
Zone	9 Total/Ave.				2,640	1,080	0	0	0	0	0	0	2,574
10	Z1-2ND FLR WEST	1	1	1,5 95	1,595	2,565	0	0	0	1,595	0	0	1,368
Zone	10 Total/Ave.				1,595	2,565	0	0	0	1,595	0	0	1,368
11		1	1	2,640	2,640	2,523	0	0	0	2,640	0	0	2,574
Zone	11 Total/Ave.				2,640	2,523	0	0	0	2,640	0	0	2,574
System	2 Total/Ave.				12,065	15,624	0	0	0	4,235	0	0	7,884
	23-BSMT SOUTH	1	1	2,202	2,202	6,539	0	0	0	0	0	0	0
Zone	12 Total/Ave.				2,202	6,539	0	0	0	0	0	0	0
	Z2-BSMT SOUTH	1	1	3,780	3,780	9,473	0	0	0	0	0	0	0
Zone	13 Total/Ave.				3,780	9,473	0	0	0	0	0	0	0
	Z1-BSMT SOUTH	1	1	3,685	3,685	8,091	0	0	0	0	0	0	49
Zone	14 Total/Ave.				3,685	8,091	0	0	0	0	0	0	49
	Z1-1ST FLR SOUTH	1	1	4,089	4,089	6,168	0	0	0	0	0	0	2,628
Zone	15 Total/Ave.				4,089	6,168	0	0	0	0	0	0	2,628
	Z2-1ST FLR SOUTH	1	1	6,002	6,002	2,415	0	0	0	0	501	14	3,171
Zone	16 Total/Ave.			7 /70	6,002	2,415	0	0	0	0	501	14	3,171
	Z3-1ST FLR SOUTH	1	1	3,430	3,430	2,352	0	0	0	0	0	0	2,475
Zone	17 Total/Ave.			/-	3,430	2,352	0	0	0	0	0	0	2,475
	Z3-2ND FLR SOUTH	1	1	5,763	5,763	3,444	0	0	0	5,763	0	0	3,348
Zone	18 Total/Ave.			2 077	5,763	3,444	0	0	0	5,763	0	0	3,348
	Z1-2ND FLR SOUTH	1	1	2,077	2,077	930 930	0	0	0	2,077	0	0	2,313
Zone 20	19 Total/Ave. 22-2ND FLR SOUTH	1	1	E 404	2,077	930	0	0	0	2,077	0	0	2,313
Zone	20 Total/Ave.	'	•	5,681	5,681 5,681	2,220	0	0	0	5,681 5,681	0	0	3,393
System	3 Total/Ave.				5,681 36,710	2,220	0	0		5,681 13 521	0 501	0	3,393 47,370
Buildin					60,840	41,631 7/, 500	0	0	0	13,521	501	3 1	17,378
+	9				00,040	74,509	v	U	U	21,991	501	ı	33,393

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 3
ECO - ECONOMIZERS ON AHUS - BUILDING 300

System Totals

Percent	Cool	ing Loa	d	Heati	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	11.0	12	574	-120,956	34	2,665	10,985.4	0	0	0.0	0	0
5 - 10	22.0	3	146	-241,912	3	201	21,970.8	0	0	0.0	0	0
10 - 15	33.1	1	63	-362,869	2	155	32,956.2	0	0	0.0	0	0
15 - 20	44.1	4	178	-483,825	6	454	43,941.6	0	0	0.0	0	0
20 - 25	55.1	1	61	-604,781	38	2,983	54,927.0	0	0	0.0	0	0
25 - 30	66.1	3	140	-725,737	18	1,423	65,912.4	0	0	0.0	0	0
30 - 35	77.2	1	69	-846,693	0	0	76,897.8	0	0	0.0	0	0
35 - 40	88.2	4	173	-967,650	0	0	87,883.2	0	0	0.0	0	0
40 - 45	99.2	4	168	-1,088,606	0	0	98,868.6	0	0	0.0	0	0
45 - 50	110.2	6	268	-1,209,562	0	0	109,854.0	0	0	0.0	0	0
50 - 55	121.2	12	547	-1,330,518	0	0	120,839.4	0	0	0.0	0	0
55 - 60	132.3	11	535	-1,451,474	0	0	131,824.8	0	0	0.0	0	0
60 - 65	143.3	10	496	-1,572,431	0	0	142,810.2	0	0	0.0	0	0
65 - 70	154.3	9	445	-1,693,387	0	0	153,795.6	0	0	0.0	0	0
70 - 75	165.3	5	258	-1,814,343	0	0	164,781.0	0	0	0.0	0	0
75 - 80	176.4	4	169	-1,935,299	0	0	175,766.4	0	0	0.0	0	0
80 - 85	187.4	4	196	-2,056,255	0	0	186,751.8	0	0	0.0	0	0
85 - 90	198.4	3	130	-2,177,211	0	0	197,737.2	0	0	0.0	0	0
90 - 95	209.4	2	108	-2,298,168	0	0	208,722.6	0	0	0.0	0	0
95 - 100	220.4	0	20	-2,419,124	0	0	219,708.0	100	8,760	0.0	0	0
Hours Off	0.0	0	4,016	0	0	879	0.0	0	0	0.0	0	8,760

 М	0	N	T	Н	L	Y	E	N	Ε	R	G	Υ	C	0	N	S	u	M	Ρ	T	1	0	N	-
 м	U	H		М	L	T	Ŀ	N	Ŀ	ĸ	G	T	U	U	N	S	U	m	۲	- 1		u	,	, K

	ELEC On Peak	DEMAND On Peak	GAS On Peak	WATER	GAS DMND On Peak
Month	(kWh)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)
Jan	307,645	557	7,058	0	10
Feb	277,922	557	6,301	0	10
March	318,032	662	6,408	11	9
April	339,990	731	3,942	124	9
May	391,884	756	2,022	257	8
June	416,305	833	246	367	3
July	433,940	837	0	409	0
Aug	436,411	830	140	392	1
Sept	393,493	<i>7</i> 59	1,696	258	8
Oct	358,005	739	4,047	136	9
Nov	301,673	653	6,279	7	9
Dec	306, 155	557	6,852	0	9
Total	4,281,456	837	44,991	1,961	10

Building Energy Consumption =

: 1424) (સ્તુલ સ્તુલ
314,129 (Btu/Sq Ft/Year)

Floor Area = 60,840 (Sq Ft)

Source Energy Consumption =

316,416 (Btu/Sq Ft/Year)

E Monthly KW = 8,471

D10-12

------ UTILITY PEAK CHECKSUMS-----

Utility ELECTRIC DEMAND

Peak Value 837.1 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

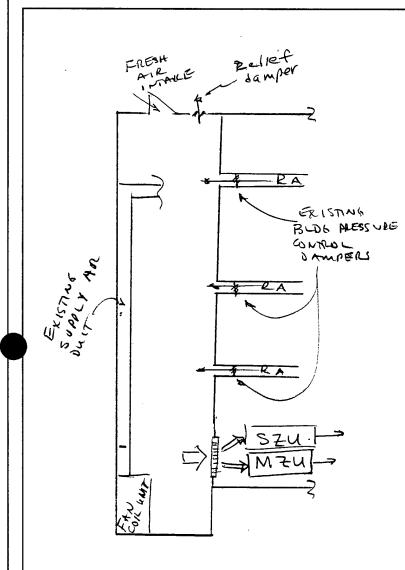
Eqp.			Utility	Percnt
Ref.	Equipment		Demand	Of Tot
Num.	Code Name	Equipment Description	(kW)	(%)
Cooling	Equipment			
1	EQ1001S	2-STG CTV <555 TONS	179.4	21.43
2	EQ1122L	AIR-CLD RECIP >55 TONS	111.1	13.27
Sub Tota	al		290.4	34.69
Sub Tota	al		0.0	0.00
Air Movi	ing Equipment			
1		SUMMATION OF FAN ELECTRICAL DEMAND	48.5	5.79
2		SUMMATION OF FAN ELECTRICAL DEMAND	33.6	4.01
3		SUMMATION OF FAN ELECTRICAL DEMAND	119.4	14.26
Sub Tota	al		201.4	24.06
Sub Tota	al		0.0	0.00
Miscella	aneous			
Lights			109.1	13.04
Base Ut	tilities		0.0	0.00
Misc Eq	quipment		236.2	28.21
Sub Tota	al		345.3	41.25
Grand To	otal		837.1	100.00

E M C ENGINEERS, INC.

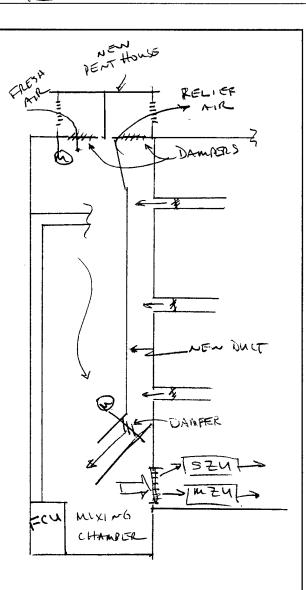
Denver • Colorado Springs • Atlanta • Germany

P300 ECONOMIZER CONCEPT

SCALE NONO



EXIST NG.



PROPOSED. MAIN BLOG.

FAST & WEST WINES ARE SIMILAR AS TO CONCEPT APPLICATION.

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

COST ESTIMATE SCALE______
FOR 1 WING.

JOB WSMR	1110,000
SHEET NO	OF
CALCULATED BY C. Butler	DATE 7-7-92
CHECKED BY	DATE

TENDLITION:	MATE	LARBR	EOUIP	TOTAL.
WALL (NOT REINF) 128 SF	/	11.30 1446	2,04 261	1708
LOAD & TRUCK (2 Mi) 4.8 CY		8.75 90	11.90 57	147
DUCTWOEK JOB.	- /	195 195		195
200F 21 SF.	3	3.28 60	2.10 44	77 P.
NEW WORK				
GALV. STL QUICT. 3600 16.	.53 1908 2	2.18 7848		9756
RELIEF VENT 1 EA	7280 7280 6	620 620	,	7900
O.B. DAMPER WIDERATOR 2 EA	500 1000	89 178		1178
LOUVER, DAMPER & DREATUR 128 ST.	45.22 5788 9	1.72 1244		70 PI
WRB 18L=	1,11 20.	.91 16.38	.04 ,72	2) 2
			-	
	i '	11,706	;	
FACTORS + (FR/BELOW)	7% 1/20 +	12% 1405		
(Ny INELON)	17,116	13,111	#	30,227
				BARE
CUT & PATON EXIST. MATE LABOR 3%				COST)
· ·				
DUST PROTECTION 170 290			•	
PROTN OF EXIST. WK. 27. 2%	:			·
TEMP. SHORING 8 BRACG 270 570				
7% 12%		:		
	-		1	
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D10-16

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION: White		•	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				ENTRAL CHILLER PLA	NT WITH THERMAL S	TORAGE	FISCAL YEAR:	1992
		DISCRETE PORTI		OTAL				
		ANALYSIS DATE:	10/26/92		ECONOMIC LIFE:	25	PREPARED BY:	T. FORSTER
	1811	VECTMENT						
•		VESTMENT	COST					
		CONSTRUCTION	COSI	= (5 mg/ -1.14)			\$165,000	
		SIOH COST DESIGN COST		(5.5% of 1A) =			\$9,075	
				(6.0% of 1A) =			\$9,900	
		ENERGY CREDIT SALVAGE VALUE		(1A + 1B + 1C) =			\$183,975	
		TOTAL INVESTME	ENIT.	45.45			\$0	
	۲.	TOTAL INVESTME	:IN I	(1D – 1E) =			 >	\$183,975
2	EN	ERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	(224)	(\$1,453)		(\$22,122)	
	В.	DIST		Ó	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	o	\$0	19.64	\$0	
	D.	PAPER		0	\$0	, , , ,	\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		(224)	(1,452.5)		 >	(\$22,122)
								,
3	NO	N-ENERGY SAVIN	GS (+) / COST (-))				
	A.	ANNUAL RECURR	RING (+/-) (ELEC.	DEMAND SAVINGS)	=		\$39,546	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	SAVINGS (+) / CO	ST (-)	(3A x 3A1) =		\$580,535	
	В.	NON-RECURRING	3 (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. UTILITY REBAT	E - KW SHIFT	\$54,788	1	0.96	\$52,596	
		b.		\$0		0.00	\$0	
		C.		\$0		0.00	\$0	
	_	d TOTAL		\$54,788			\$52,596	
				ED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$633 ,132
	U.	PROJECT NON-E		241 0111 471011				
		1 25% MAXIMUM		JALCULATION		(2F5 x 0.33) =	(\$7,300)	
		a IF 3D1 => 3C T		- OID				
		b IF 3D1 < 3C TH c IF 3D1b => 1 T		: SIH		(2F5 + 3D1) / 1F =	-0.16	
				OFC NOT OUR UEV				
		0 1F3D10<11F	IEN PROJECT D	OES NOT QUALIFY				
4	FIR	RST YEAR DOLLAR	SAVINGS (+) / CO	OSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$40,285
		TAL NET DISCOUN			•	(2F5 + 3C) =		\$611,010
6	DIS	SCOUNTED SAVING	SS-TO-INVESTM	IENT RATIO (SIR)		(5/1F) =		3.32
		SIR < 1 THEN PRO				. ,		
7	SIM	MPLE PAYBACK (SP	'B)			(1F/4) =		4.6
						• ,		

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	WN							
CONTRACTOR				ADDRESS 2750 SOU	TH WADSW	ОВТН ВСИ)., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	5 80227	
CONTRACT FC	CONTRACT FOR (Work to be performed)	STOBAGE] E	008			PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE RE	EXISTING CHILLER PLANT WITH THENWAL STOTENCE PURCHASE REQUEST NUMBER		1	PROJECT NUMBER	5		WORKLOCATION WHITE SAN	ADS MISSILE	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	cost		LABOR COSTS			-
Line No.	Item	Unit of Measure	Quantity	Unit	Total	Manhours Mandays	Average Rate	Total	Other Direct Costs (9)	Line Total (10)
	(1)	(2)	9	(4)	2	6				
	EXSTNG CHILLER PLANT W/ THERMAL STOHAGE									\$150,000
	THERMAL STORAGE TANK & CONNECTIONS	E	-	150000	150000	150000 Material & Labor	50			
	CONTINGENCY (10%)									\$15,000
							:			
	TOTAL TUIC CUEST									\$165,000
	COLAL ITIES STILL: Section of the second of	Labor Costs Inclu	ide 25% Overhee	d & Profft						

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TRACE 600 ANALYSIS
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ESOS STUDY AT WSMR - BUILDING 300 WHITE SANDS MISSILE RANGE NM US ARMY

EMC ENGINEERS, INC.

RANGE CONTROL BLDG: ALT 1-BSLN, ALTZ-ECO EXISTING CHILLER PLANT W/THERMAL STORAGE

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20 Air Density: 0.0653 (Lbm/cuft) Air Specific Heat: 0.2444 (Btu/lbm/F)

3.9171 (Lb-min./hr/cuft) Design Simulation Period: January To December System Simulation Period: January To December

Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run:

Density-Specific Heat Prod:

Latent Heat Factor:

Enthalpy Factor:

18: 5:50 3/13/92

0.9575 (Btu-min./hr/cuft/F)

4,214.8 (Btu-min./hr/cuft)

Dataset Name:

distribution.

300 .TM

Block

- DOUBLE DUCT

System

Peaked at Time ==> Mo/Hr: 7/16 Mo/Hr: 7/16 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 OADB: 97 OADB: 24 Ret. Air Ret. Air Space Net Percnt Space Percnt * Space Peak Coil Peak Percnt Sens.+Lat. Sensible Latent Of Tot Total Sensible Of Tot Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr 0 0 0 0.00 0 0.00 0 0 0.00 Skylite Cond 0 Ð 0 0.00 ก 0.00 0 0.00 Roof Cond 0 12,734 12,734 2.70 0.00 O -13,550 3.56 Glass Solar 0 n Ð 0.00 0.00 0 0.00 Glass Cond 0 O 0 0.00 0 0.00 O 0 0.00 Wall Cond 81,136 27,781 108,917 23.06 28.85 * 81,117 -128,969 -173,237 45.46 Partition -4,965 -4,965 -1.05 -4,965 -1.77 -60,134 -60,134 15.78 Exposed Floor 0 0 0.00 0 0.00 0 0 0.00 Infiltration 6,185 6,185 1.31 7,886 2.80 -14,848 -14,848 3.90 Sub Total ==> 82,355 40,515 122,871 26.01 84,038 29.88 -203,952 -261,770 68.69 Internal Loads Lights 60,341 0 60,341 12.77 60,341 21.46 0 0 0.00 People 27,300 27,300 5.78 14,950 5.32 0 0 0.00 Misc 103,877 0 103,877 21.99 103,877 36.94 0 0.00 Sub Total ==> 191,518 0 191,518 40.54 179,168 63.71 0 0.00 Ceiling Load 3,991 0.00 3,230 1.15 -4,628 0.00 Outside Air . 0 0 62,240 13.18 0.00 -149,417 39.21 Sup. Fan Heat 84,211 17.83 0.00 84,211 -22.10 Ret. Fan Heat n 0 0.00 0.00 0 0.00 **Duct Heat Pkup** 0 0.00 0.00 0 0.00 OV/UNDR Sizing 14,770 14,770 3.13 14,770 5.25 -58,220 -58,220 15.28 Exhaust Heat -3,250 0 -3,250 -0.69 0.00 4,116 -1.08 Terminal Bypass 0 O -0.00 0.00 0.00 Grand Total ==> 292,634 33,274 472,359 100.00 * 281,206 100.00 * -266,799 -381,080 100.00 -----COOLING COIL SELECTION-----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Glass (sf) (%) **Gross Total** (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 12,065 Main Clg 39.4 472.4 478.2 46,440 74.7 58.0 56.8 63.8 54.1 57.3 17,254 Part Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 Roof 4,235 O U Totals 39.4 472.4 Wall 8,132 -----HEATING COIL SELECTION---------- AIRFLOWS (cfm)-------- ENGINEERING CHECKS ----TEMPERATURES (F)---Capacity Coil Airfl Lvg Type Cooling **Heating** Clg % OA 7.0 Type Clg Htg (Mbh) (cfm) Deg F Deg F Vent 3,251 3,251 Clg Cfm/Sqft 3.85 SADB 65.7 78.0 Main Htg -340.6 46,440 70.3 78.0 Infil 323 323 Clg Cfm/Ton 1179.78 Plenum 73.0 70.5 Aux Htg 0.0 0 0.0 0.0 Supply 46,440 46,440 Clg Sqft/Ton 306.51 Return 73.0 70.7 Preheat -0.0 46,440 67.4 63.8 Mincfm 0 0 Clg Btuh/Sqft 39.15 Ret/OA 67.4 Reheat 0.0 0 0.0 0.0 Return 46,440 46,440 No. People 65 Runarnd 72.0 72.0 Humidif 0.0 0 0.0 0.0 **Exhaust** 3,251 3,251 Htg % OA 7.0 Fn MtrTD 0.6 0.0 Opt Vent 0.0 0 0.0 0.0 Rm Exh 0 Htg Cfm/SqFt 3.85 Fn BldTD 0.5 0.0 Total -340.6 Auxil Htg Btuh/SqFt -28.23 **Fn Frict**

10-1-10-1-10-1

Reheat

Humidif

Opt Vent

Total

0.0

0.0

0.0

-420.2

System 2 Block DD - DOUBLE DUCT Peaked at Time ==> Mo/Hr: 7/16 Mo/Hr: 7/16 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 OADB: 97 OADB: 24 Space Ret. Air Ret. Air Net Percnt * Space Percnt * Space Peak Coil Peak Sens.+Lat. Sensible Latent Total Of Tot * Sensible Of Tot Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr 0 Ð 0 0.00 O 0.00 * 0 0 0.00 Skylite Cond 0 0 0.00 * 0 0.00 * 0 0 0 0.00 Roof Cond 0 12,709 12,709 2.03 * 0 0.00 * 0 -13,608 4.14 Glass Solar 0 0 0 0.00 * 0 0.00 O 0 0.00 Glass Cond O n 0 0.00 0 0.00 * 0 0 0.00 Wall Cond 72,716 24,577 97,293 15.58 72,716 16.75 * -124,832 -167,314 50.84 Partition -5,411 -0.87 -5,411 -5,411 -1.25 -64,928 -64,928 19.73 Exposed Floor 0 O 0.00 0.00 0 0 0.00 Infiltration 7,121 7,121 1.14 7,885 1.82 -14,848 -14,848 4.51 Sub Total ==> 74,427 37,286 111,713 17.89 75,191 17.32 -204,608 -260,698 79.22 Internal Loads Lights 73,523 0 73,523 11.77 * 73,523 16.93 * 0 0 0.00 People 19,740 19,740 3.16 * 10,810 2.49 * 0 0 0.00 Misc . 266,323 0 0 266,323 42.64 266,323 61.34 * 0 0 0.00 Sub Total ==> 359,585 0 n 359,585 57.57 * 350,655 80.76 * O 0 0.00 Ceiling Load 4,319 -4.319 0 0.00 3,459 0.80 * -5,209 0.00 Outside Air n 60,882 9.75 0.00 * 0 0 -126,942 38.58 Sup. Fan Heat 90,495 14.49 0.00 * 90,495 -27.50 Ret. Fan Heat 0 0.00 * 0.00 * 0 0.00 Duct Heat Pkup 0 0.00 * 0.00 * n 0.00 OV/UNDR Sizing 4,876 4,876 0.78 * 4,876 1.12 * -35,774 -35,774 10.87 Exhaust Heat -2.988 0 -2,988 -0.48 0.00 * 3,851 -1.17 Terminal Bypass O 0 0 -0.00 0.00 * 0.00 Grand Total ==> 443,207 29,979 624,563 100.00 * 434,181 100.00 * -245,591 -329,069 100.00 -----COOLING COIL SELECTION-----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/W8/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 12,065 Main Clg 52.0 624.6 622.4 39,460 74.8 57.0 52.4 58.1 50.8 52.5 Part 15,624 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Exflr 0 Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 4,235 Roof 0 Totals 52.0 624.6 Wall 7,884 ------HEATING COIL SELECTION----------AIRFLOWS (cfm)------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Lvg Type Cooling Heating Clg % OA 7.0 Type Clg Htg (Mbh) (cfm) Deg F Deg F Vent 2,762 2,762 Clg Cfm/Sqft 3.27 SADB 60.5 78.5 Main Htg -420.239,460 67.4 78.5 Infil 323 323 Clg Cfm/Ton 758.16 **Plenum** 73.1 70.4 Aux Htg 0.0 0 0.0 0.0 Supply 39,460 39,460 Clg Sqft/Ton 231.81 Return 73.1 70.5 Preheat -0.0 39,460

0

0

0

39,460

2,762

0

39,460

2,762

Ð

Clg Btuh/Sqft

No. People

Htg Cfm/SqFt

Htg Btuh/SqFt

Htg % OA

51.77

47

7.0

3.27

-34.83

Ret/OA

Runarnd

Fn MtrTD

Fn BldTD

Fn Frict

74.8

72.0

0.8

0.6

1.8

67.3

72.0

0.0

0.0

0.0

67.3

0.0

0.0

0.0

0

0

0

58.1

0.0

0.0

0.0

Mincfm

Return

Exhaust

Rm Exh

Auxil

System

nobbian

 DOUBLE DUCT 3 Block DD

Mo/Hr: 7/16 Mo/Hr: 13/ 1 Peaked at Time ==> Mo/Hr: 7/16 OADB: 97 OADB: 24 Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 Percnt * Space Peak Coil Peak Net Percnt Space Percnt Space Ret. Air Ret. Air Of Tot * Sensible Space Sens Tot Sens Of Tot Latent Total Of Tot Sens.+Lat. Sensible **(%)** (Btuh) (Btuh) (%) (Btuh) (%) (Btuh) (Btuh) (Btuh) Envelope Loads (Btuh) 0.00 O 0.00 0 0 0.00 O 0 Skylite Solr O 0 0.00 n 0 0.00 0.00 0 0 0 Skylite Cond 0.00 0 -43.963 5.50 O 41,022 2.65 Roof Cond 0 41,022 4.51 * n 0 0.91 40,581 0.00 0 14,028 14,028 Glass Solar 0.65 * -16,967 -16,967 2.12 0.53 5,819 8,239 0 Glass Cond 8,239 15.06 * -266,726 -361,665 45.23 12.94 135,487 200,366 Wall Cond 147,401 52,964 -149,871 -149,871 -1.44 18.74 -12,991 -0.84 -12,991 Partition -12,991 0.00 * 0 0 0.00 0 0.00 Exposed Floor 0 2.57 * -45,361 -45,361 5.67 1.29 23,124 20,007 Infiltration 20,007 21.34 -478,926 -617,828 77.27 192,019 270,670 17.48 93,986 Sub Total ==> 176,683 Internal Loads 0.00 15.41 238,645 26.52 * 0 0 238,645 0 238,645 Lights 3.94 * 0 0 0.00 64,680 4.18 35,420 People 64,680 425,318 425,318 47.27 * 3,208 3,208 -0.40 27.47 Misc 425,318 0 699,382 77.72 * 3,208 3,208 -0.40 Sub Total==> 728,643 47.06 728,643 0 7,258 0.81 -11,689 0 0.00 0 0.00 Ceiling Load 7,657 -7,657 0.00 0 -430,464 53.84 0 189,859 12.26 . 0 Outside Air 363,958 23.51 0.00 363,958 -45.52 Sup. Fan Heat 0 0.00 0.00 0 0.00 Ret. Fan Heat 0 0.00 * 0 0.00 0.00 Duct Heat Pkup 0 0 1,182 80.0 1,182 0.13 * -127,578 -127,578 15.96 OV/UNDR Sizing 1,182 -5.903 -5,903 -0.38 0.00 * 9,137 -1.14 Exhaust Heat 0 -0.00 0.00 * 0.00 Terminal Bypass 0 -614,985 100.00 * -799,567 100.00 Grand Total ==> 914,165 80,427 1,548,408 100.00 * 899.842 -----COOLING COIL SELECTION----------AREAS-----Entering DB/WB/HR Sens Cap. Coil Airfl Leaving DB/WB/HR **Gross Total** Glass (sf) (%) Total Capacity Deg F Floor 36,710 (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Grains 129.0 1,548.4 1,560.1 133,808 74.4 57.5 55.1 62.1 53.0 55.3 Part 41,631 Main Clg Aux Clg 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 0 0.0 0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 13,521 Opt Vent 0.0 Ual I 17,879 501 3 Totals 129.0 1,548.4 -----AIRFLOWS (cfm)------- ENGINEERING CHECKS----TEMPERATURES (F)---------HEATING COIL SELECTION------Cooling Heating Clg % OA 7.0 Type Clg Hta Capacity Coil Airfl Ent Lvg Type 9,366 Clg Cfm/Sqft 3.64 SADB 65.0 76.8 9.366 (Mbh) (cfm) Deg F Deg F Vent 987 987 Clg Cfm/Ton 1037.00 72.7 70.9 Plenum Main Htg -1,219.0 133.808 67.3 76.8 Infil 72.7 0.0 0 0.0 0.0 133,808 133.808 Clg Sqft/Ton 284.50 Return 71.0 Aux Htg Supply 0 0 Clg Btuh/Sqft 42.18 Ret/OA 74.4 Preheat -0.0 133,808 67.7 62.1 Mincfm 133,808 133,808 No. People 154 Runarnd 72.0 72.0 0.0 0 0.0 0.0 Return Reheat 7.0 9,366 Htg % OA Fn MtrTD 0.9 0.0 -439.3 4.7 75.1 9.366 Humidif 10,353 Exhaust 3.64 Opt Vent 0.0 0 0.0 0.0 Rm Exh 0 0 Htg Cfm/SqFt Fn BldTD 0.7 0.0 Auxil 0 0 Htg Btuh/SqFt -33.21 Fn Frict 2.1 0.0 Total -1,658.3

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 300

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BUILDING U-VALUES-----

						oom U-V tu/hr/s					Room Mass	Room Capac.
Roo	m			Summ				r Wint	r		(lb/	(Btu/
Numbe	r Description	Part.	. ExFlr					o Windo		l Ceil.	sqft)	sqft/F)
	1 Z1-BSMT EAST	0.652	2 0.000	0.000	0.000	0.00	0.00	0.000	0.550	0.317	234.7	46.30
Zone	1 Total/Ave	. 0.652	0.000	0.000	0.000	0.000					234.7	46.30
	Z Z1-1ST FLR EAST	0.127	0.000	0.000	0.000						104.1	20.20
Zone	2 Total/Ave	. 0.127	0.000	0.000	0.000						104.1	20.20
3	Z2-1ST FLR EAST	0.128	0.000	0.000	0.000						76.4	15.07
Zone	3 Total/Ave	. 0.128	0.000	0.000							76.4	15.07
4	Z1-2ND FLR EAST	0.169	0.000	0.000							142.8	28.70
Zone	4 Total/Ave	. 0.169	0.000	0.000							142.8	28.70
5	Z2-2ND FLR EAST	0.133	0.000	0.000	0.000						132.4	26.83
Zone	5 Total/Ave	. 0.133	0.000	0.000							132.4	26.83
System	1 Total/Ave	. 0.393	0.000	0.000							148.3	29.43
6	Z1-BSMT WEST	0.821	0.000	0.000	0.000						235.1	46.60
Zone	6 Total/Ave	0.821	0.000	0.000	0.000				0.000		235.1	46.60
7	Z2-BSMT WEST	0.745	0.000	0.000	0.000	0.000			0.000	0.317	403.3	79.96
Zone	7 Total/Ave.	0.745	0.000	0.000	0.000	0.000			0.000	0.317	403.3	
8	Z1-1ST FLR WEST	0.172	0.000	0.000	0.000	0.000			0.462	0.317	99.4	19.22
Zone	8 Total/Ave.	0.172	0.000	0.000	0.000	0.000			0.462	0.317	99.4	19.22
9	Z2-1ST FLR WEST	0.388	0.000	0.000	0.000	0.000			0.438	0.317	74.0	14.73
Zone	9 Total/Ave.	0.388	0.000	0.000	0.000	0.000	0.000		0.438	0.317	74.0	14.73
10	Z1-2ND FLR WEST	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
Zone	10 Total/Ave.	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
11	Z2-2ND FLR WEST	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
Zone	11 Total/Ave.	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
System	2 Total/Ave.	0.472	0.000	0.000	0.000	0.070	0.000	0.000	0.446	0.317	152.2	30.37
12	Z3-BSMT SOUTH	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
Zone	12 Total/Ave.	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
13	Z2-BSMT SOUTH	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
Zone	13 Total/Ave.	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
14	Z1-BSMT SOUTH	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
Zone	14 Total/Ave.	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
15	Z1-1ST FLR SOUTH	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
Zone	15 Total/Ave.	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
16	Z2-1ST FLR SOUTH	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
Zone	16 Total/Ave.	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
17	Z3-1ST FLR SOUTH	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
Zone	17 Total/Ave.	0.130	0.000	0.000	0.000			0.000			61.0	11.82
18	Z3-2ND FLR SOUTH				0.000	0.070	0.000		0.438	0.317	112.1	23.09
Zone	18 Total/Ave.	0.187	0.000		0.000	0.070	0.000		0.438	0.317	112.1	
19	Z1-2ND FLR SOUTH				0.000	0.070	0.000		0.438	0.317	141.0	23.09
Zone	19 Total/Ave.				0.000	0.070	0.000			0.317	141.0	28.94
20	Z2-2ND FLR SOUTH					0.070			0.438	0.317	107.3	28.94
Zone	20 Total/Ave.				0.000		0.000			0.317	107.3	22.16
System	3 Total/Ave.						0.653		0.437			22.16
Building											129.1	25.81
					- 1000		0.000	0.100	0.446	0.317	137.5	27.43

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 300

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BUILDING AREAS -----

				Floor	Total		Exposed						
		Numb	er of	Area/Dupl	Floor	Partition	Floor	Skylight		Net Roof			Net Wall
Room		Dupl	icate	Room	Area	Area	Area	Area	/Rf	Area	Area	/WL	Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	Z1-BSAST 1	1		3,595	3,595	8,458	0	0 0		0	0 0		247
Zone	1 Total/Ave.	•		2,5.5	3,595	8,458	0	0	0	0	0	0	247
	Z1-1ST FLR EAST	1	1	1,595	1,595	2,145	0	0	0	0	0	0	1,368
Zone	2 Total/Ave.	•	1 <u>0</u> 1	1,070	1,595	2,145	0	0	0	0	0	0	1,368
	Z2-1ST FLR EAST	1	1	2,640	2,640	858	0	0	0	0	0	0	2,574
Zone	3 Total/Ave.	•	•	-,	2,640	8 58	0	0	0	0	0	0	2,574
2012		1	1	1,595	1,595	3,045	0	0	0	1,595	0	0	1,368
Zone	4 Total/Ave.	•	•	1,575	1,595	3,045	0	0	0	1,595	0	0	1,368
201RE 5		1	1	2,640	2,640	2,748	0	0	0	2,640	0	0	2,574
Zone	5 Total/Ave.	•	•	2,010	2,640	2,748	0	0	0	2,640	0	0	2,574
System	1 Total/Ave.				12,065	17,254	0	0	0	4,235	0	0	8,132
•	Z1-BSNT WEST	1	1	3,280	3,280	5,763	0	- 0	0	0	0	0	0
Zone	6 Total/Ave.	•	•	-,	3,280	5,763	0	0	0	0	0	0	0
	Z2-BSMT WEST	1	1	315	315	909	0	0	0	0	0	0	0
Zone	7 Total/Ave.				3 15	909	0	0	0	0	0	0	0
	Z1-1ST FLR WEST	1	1	1,595	1,595	2,784	0	0	0	0	0	0	1,368
Zone	8 Total/Ave.			•	1,595	2,784	0	0	0	. 0	0	0	1,368
9		1	1	2,640	2,640	1,080	0	0	Ð	0	0	0	2,574
Zone	9 Total/Ave.			•	2,640	1,080	0	0	0	0	0	0	2,574
10	Z1-2ND FLR WEST	1	1	1,595	1,595	2,565	0	. 0	0	1,595	0	0	1,368
Zone	10 Total/Ave.			-	1,595	2,565	0	0	0	1,595	0	0	1,368
11	Z2-2ND FLR WEST	1	1	2,640	2,640	2,523	0	0	0	2,640	0	0	2,574
Zone	11 Total/Ave.				2,640	2,523	0	0	0	2,640	0	0	2,574
System	2 Total/Ave.				12,065	15,624	0	0	0	4,235	0	0	7,8 84
12	Z3-BSMT SOUTH	1	1	2,202	2,202	6,539	0	0	0	0	0	0	0
Zone	12 Total/Ave.				2,202	6,539	0	0	0	0	0	0	0
13	Z2-BSMT SOUTH	1	1	3,780	3,780	9,473	0	0	0	0	0	0	0
Zone	13 Total/Ave.				3,780	9,473	0	0	0	0	0	0	0
14	Z1-BSMT SOUTH	1	1	3,685	3,685	8,091	0	0	0	0	0	0	49
Zone	14 Total/Ave.				3,685	8,091	0	0	0	0	0	0	49
15	Z1-1ST FLR SOUTH	1	1	4,089	4,089	6,168	0	()	0	0 ()	2,628
Zone	15 Total/Ave.				4,089	6,168	0	0	0	0	0	0	2,628
16	Z2-1ST FLR SOUTH	1	1	6,002	6,002	2,415	0	0	0	0	501	14	3,171
Zone	16 Total/Ave.				6,002	2,415	0	0	0	0	501	14	3,171
17	Z3-1ST FLR SOUTH	1	1	3,430	3,430	2,352	0	0	0	0	0	0	2,475
Zone	17 Total/Ave.				3,430	2,352	0	0	0	. 0	0	0	2,475
18	Z3-2ND FLR SOUTH	1	1	5,763	5,763	3,444	0	0	0	5,763	0	0	3,348
Zone	18 Total/Ave.				5,763	3,444	0	0	0	5,763	0	0	3,348
19	Z1-2ND FLR SOUTH	1	1	2,077	2,077	93 0	0	0	0	2,077	0	0	2,313
Zone	19 Total/Ave.				2,077	93 0	0	0	0	2,077	0	0	2,313
20	Z2-2ND FLR SOUTH	1	1	5,681	5,681	2,220	0	0	0	5,681	0	0	3,393
Zone	20 Total/Ave.				5,681	2,220	0	0	0	5,681	0	0	3,393
System	3 Total/Ave.				36,710	41,631	0	0	0	13,521	501	3	17,378
Buildin	g .				60,840	74,509	0	0	0	21,991	501	1	33,393

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1 BASELINE BUILDING 300

System Totals

Percent	Cool	ing Loa	id	Heati	ng Load		Cooling	Airflo	d	Heating	Airflo	4
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	11.0	0	0	-120,956	22	946	10,985.4	0	0	0.0	0	0
5 - 10	22.0	0	0	-241,912	19	817	21,970.8	0	0	0.0	0	o
10 - 15	33.1	0	0	-362,869	15	659	32,956.2	0	0	0.0	0	0
15 - 20	44.1	10	872	-483,825	12	519	43,941.6	0	0	0.0	0	0
20 - 25	55.1	17	1,491	-604,781	13	556	54,927.0	0	0	0.0	0	0
25 - 30	66.1	12	1,025	-725,737	8	364	65,912.4	0	0	0.0	0	0
30 - 35	77.2	7	624	-846,693	6	238	76,897.8	0	0	0.0	0	Ô
35 - 40	88.2	9	801	-967,650	5	218	87,883.2	0	0	0.0	0	0
40 - 45	99.2	5	448	-1,088,606	0	0	98,868.6	0	0	0.0	0	0
45 - 50	110.2	8	730	-1,209,562	0	0	109,854.0	0	0	0.0	0	0
50 - 55	121.2	7	593	-1,330,518	0	0	120,839.4	0	0	0.0	0	0
55 - 60	132.3	5	427	-1,451,474	0	0	131,824.8	0	0	0.0	0	0
60 - 65	143.3	5	438	-1,572,431	0	0	142,810.2	0	0	0.0	0	0
65 - 70	154.3	5	432	-1,693,387	0	0	153,795.6	0	0	0.0	0	0
70 - 75	165.3	3	235	-1,814,343	0	0	164,781.0	0	0	0.0	0	0
75 - 80	176.4	2	212	-1,935,299	0	0	175,766.4	0	0	0.0	0	0
80 - 85	187.4	2	154	-2,056,255	0	0	186,751.8	0	0	0.0	0	0
85 - 90	198.4	2	150	-2,177,211	0	0	197,737.2	0	0	0.0	0	0
90 - 95	209.4	1	108	-2,298,168	0	0	208,722.6	0	0	0.0	0	0
95 - 100	220.4	0	20	-2,419,124	0	0	219,708.0	100	8,760	0.0	0	0
Hours Off	0.0	0	0	0	0	4,443	0.0	0	0	0.0	0	8,760

------ MONTHLY ENERGY CONSUMPTION -----

					040 0440
	ELEC	DEMAND	GAS		GAS DMND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(kWh)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)
Jan	368,811	707	6,458	121	14
Feb	334,023	707	5,227	111	14
March	380,280	706	2,512	147	8
April	378,364	705	585	189	3
May	416,460	728	9	252	0
June	430,028	748	0	288	0
July	446,446	754	0	310	0
Aug	447,660	749	0	303	0
Sept	407,210	733	0	252	0
Oct	397,986	712	782	201	4
Nov	364,146	704	2,815	141	9
Dec	370,091	709	_ 5,163	128	11
Total	4.741.504	754	23.551	2,441	14

Building Energy Consumption =

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304,696 (Btu/Sq Ft/Year)

Floor Area = 60,840 (Sq Ft)

Source Energy Consumption = 305,893 (Btu/Sq Ft/Year)

Zmonthly kw= 8,662

COLD THERMAL STORAGE - ALTERNATIVE 1

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

----- Design -----

January

	Design								
	Des	ign	Cooling	Chiller	Chiller	Storage			
	OADB	OAWB	Load	Load	Demand	Capacity			
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)			
1	32.8	22.9	51.0	51.0	43.2	2,000			
2	31.5	21.9	47.8	47.8	41.6	2,000			
3	30.4	20.9	45.2	45.2	40.3	2,000			
4	29.6	20.4	43.4	43.4	39.5	2,000			
5	29.4	20.0	41.6	41.6	38.6	2,000			
6	29.9	20.7	39.8	39.8	37.7	2,000			•
7	31.2	22.0	38.2	38.2	36.9	2,000			
8	33.6	24.0	40.7	0.0	0.0	1,959			
9	37.0	26.5	52.6	0.0	0.0	1,907			
10	40.9	28.5	57.9	0.0	0.0	1,849			
11	45.4	30.7	64.7	0.0	0.0	1,784			
12	49.6	34.1	71.8	0.0	0.0	1,712			
13	52.7	36.1	76.0	0.0	0.0	1,636			
14	54.8	36.7	80.3	0.0	0.0	1,556			
15	55.6	37.2	84.6	0.0	0.0	1,471			
16	54.8	36.8	88.5	0.0	0.0				
17	53.0	35.6	73.8	0.0	0.0	1,309			
18	50.1	34.0	66.4	0.0	0.0	1,243			
19	46.7	31.7	62.1	290.7	265.0	1,471			
20	43.3	29.9	57.1	290.7		1,705			
21	40.4	28.1	54.6	290.7	265.0	1,941			
22	37.8	26.4	52.2	111.2	86.6	2,000			
23	35.7	24.9	49.5	49.5		•			
24	34.1	23.9	47.1	47.1	41.3	2,000			
				Uc	ekday			Sa	turdov
	Τv	pical	Cooling		•	Storage		Chiller	•
	OADB	OAWB	Load	Load	Demand		Load	Load	Demand
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)

				We	ekday	******	Saturday			
	Ту	oical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	OADB	OAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	36.9	28.0	44.7	44.7	40.1	2,000	45.3	45.3	40.4	2,000
2	34.1	25.7	43.6	43.6	39.5	2,000	44.2	44.2	39.8	2,000
3	31.6	23.5	42.3	42.3	38.9	2,000	42.9	42.9	39.2	2,000
4	29.5	21.9	41.3	41.3	38.4	2,000	41.8	41.8	38.7	2,000
5	28.0	20.5	40.1	40.1	37.8	2,000	40.7	40.7	38,1	2,000
6	27.0	20.1	38.9	38.9	37.2	2,000	39.5	39.5	37.5	2,000
7	26.7	20.4	38.1	38.1	36.9	2,000	38.7	38.7	37.2	2,000
8	27.3	21.4	40.4	0.0	0.0	1,960	37.8	0.0	0.0	1,962
9	29.2	23.1	50.9	0.0	0.0	1,909	37.3	0.0	0.0	1,925
10	32.1	24.4	55.1	0.0	0.0	1,854	36.8	0.0	0.0	1,888
11	35.8	26.3	60.4	0.0	0.0	1,793	36.5	0.0	0.0	1,852
12	39.8	28.8	65.6	0.0	0.0	1,728	36.6	0.0	0.0	1,815
13	43.9	31.5	68.6	0.0	0.0	1,659	36.9	0.0	0.0	1,778
14	47.5	33.8	72.1	0.0	0.0	1,587	37.5	0.0	0.0	1,741
									•	

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

COLD THERMAL STORAGE - ALTERNATIVE 1

									Sai	turday	
			•			kday		rooling	Chiller	Chiller	Storage
		Typic	al (cooling		Chiller	Storage Capacity	Load	Load	Demand	Capacity
	OAD	B 0	AWB	Load	Load	Demand	- •	(Ton)	(Ton)	(kW)	(Ton-Hr)
Hour	(F	•	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(TOI)	(,		
					• •	0.0	1,311	42.5	0.0	0.0	1,580
18	52.	.6 3	7.9	56.9	0.0	265.0	1,548	44.3	290.7	265.0	1,826
19	51.	.6 3	8.7	53.2	290.7		1,790	45.5	219.4	186.6	2,000
20	50	.1 3	8.3	48.9	290.7	265.0	2,000	46.4	46.4	40.9	2,000
21	48		37.0	47.7	257.6	229.1	2,000	46.0	46.0	40.7	2,000
22	45	.5 3	55.2	47.2	47.2	41.3	2,000	45.6	45.6	40.5	2,000
23	42	.7	32.9	46.6	46.6	41.0	-	45.1	45.1	40.3	2,000
24	39	.8	30.3	45.5	45.5	40.5	2,000	43.1	4511	,	
						Sunday			1	Monday	
						•	Storage	Cooling	Chiller	Chiller	Storage
		Typi		Cooling		Demand	Capacity	Load			Capacity
	O/	/DB	OAWB	Load	Load	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
Hou	r ((F)	(F)	(Ton)	(Ton)	(KW)	(101)	, , ,			
					,, =	40.0	2,000	43.8	43.8	39.6	2,000
		6.9	28.0				2,000	42.9	42.9	39.2	2,000
	_	4.1	25.7	43.6			2,000	41.8	3 41.8	38.6	2,000
	-	1.6	23.5	42.4			2,000	40.8		38.2	2,000
		9.5	21.9	41.4			2,000	39.	7 39.	7 37.6	2,000
	-	8.0	20.5	40.4			2,000	38.	6 38.		2,000
	_	7.0	20.1	39.2			2,000		9 37.	9 36.8	
	-	6.7	20.4	38.			1,962		2 0.	0.0	1,960
	_	27.3	21.4	37.0			1,925		7 0.	0.0	1,909
	-	29.2	23.1							0.0	1,854
		32.1	24.4			-			2 0.	0.0	1,794
	• •	35.8	26.3			•			.5 0.	0.0	1,728
		39.8	28.8				•		,5 0.	.0 0.0	1,660
		43.9	31.5		•	-			_	.0 0.0	1,588
	• •	47.5	33.8							.0 0.0	1,512
	•	50.4	35.9		_				.9 0	.0 0.0	1,433
	16	52.3	37.						.6 0	.0 0.0	1,369
	17	52.9	37.			.0 0.0				.0 0.0	1,312
	18	52.6	37.		•	• •		-	.1 290	.7 265.0	
	19	51.6	38.			• • • • • • • • • • • • • • • • • • • •			.9 290		
	20	50.1	38.						.7 256	3.4 227.7	
	21	48.0	37.				·			7.2 41.3	
	22	45.5	35.				•			5.6 41.0	
	23	42.7		-						5.5 40.5	2,000
	24	39.8	30.	.3 45	5.1 45	40.					

COLD THERMAL STORAGE - ALTERNATIVE 1

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

July

				De	eian					
	Desi	an		Chiller	_	Storage				
	OADB	CAWB	Load	Load	Demand	Capacity				
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)				
	•	* * *	• • • • • • • • • • • • • • • • • • • •	•••••	••	••••••				
1	79.1	56.4	131.8	290.7	281.4	1,201				
2	78.0	55.8	126.7	290.7	278.8	1,365				
3	77.2	55.5	122.2	290.7	277.1	1,533				
4	76.5	55.1	118.1	290.7	275.5	1,706				•
5	76.3	55.9	115.2	290.7	275.9	1,881				
6	76.7	56.8	113.6	232.4	212.4	2,000		•		
7	77.8	57.7	113.1	113.1	80.7	2,000				
8	79.8	57.9	123.5	0.0	0.0	1,877				
9	82.6	59.0	155.0	0.0	0.0	1,722				
10	85.8	60.3	168.9	0.0	0.0	1,553				
11	89.5	61.3	184.8	0.0	0.0	1,368				
12	93.0	62.7	198.6	0.0	0.0	1,169				
13	95.6	63.5	205.4	0.0	0.0	964				
14	97.3	63.9	211.3	0.0	0.0	753				
15	98.0	64.0	215.7	0.0	0.0	537				
16	97.3	63.6	217.4	0.0	0.0	319				
17	95.8	62.6	196.2	0.0	0.0	123				
18	93.4	61.3	179.2	56.0	46.6	0				
19	90.6	60.1	169.6	290.7	306.0	121				
20	87.8	58.5	158.8	290.7	299.1	253				
21	85.4	57.9	153.2	290.7	294.2	390				
22	83.2	57.5	148.5	290.7	289.8	533				
23	81.5	57.3	143.2	290.7	286.6	680				
24	80.2	56.9	137.7	200.7	207 0	977				
		20.7	13/./	290.7	283.9	833				
		JU. 7							i	
	_			We	ekday	********			turday	
		pical	Cooling	Chiller	ekday Chiller	Storage	Cooling	Chiller	Chiller	Storage
	OADB	pical OAWB	Cooling Load	Chiller Load	ekday Chiller Demand	Storage Capacity	Cooling Load	Chiller Load	Chiller Demand	Storage Capacity
Hour		pical	Cooling	Chiller	ekday Chiller	Storage	Cooling	Chiller	Chiller	Storage
	OADB (F)	pical OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	ekday Chiller Demand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
1	OADB (F) 79.5	pical OAWB (F) 63.5	Cooling Load (Ton)	Chiller Load (Ton)	ekday Chiller Demand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton) 290.7	Chiller Demand (kW) 290.4	Storage Capacity (Ton-Hr)
1 2	OADB (F) 79.5 77.5	pical OAWB (F) 63.5 62.1	Cooling Load (Ton) 128.2 122.5	Chiller Load (Ton) 290.7 290.7	ekday Chiller Demand (kW) 290.4 285.0	Storage Capacity (Ton-Hr) 996 1,164	Cooling Load (Ton) 131.6 125.5	Chiller Load (Ton) 290.7 290.7	Chiller Demand (kW) 290.4 285.0	Storage Capacity (Ton-Hr) 1,049 1,215
1 2 3	OADB (F) 79.5 77.5 75.7	OAWB (F) 63.5 62.1 61.1	Cooling Load (Ton) 128.2 122.5 117.3	Chiller Load (Ton) 290.7 290.7	ekday Chiller Demand (kW) 290.4 285.0 280.6	Storage Capacity (Ton-Hr) 996 1,164 1,337	Cooling Load (Ton) 131.6 125.5 120.0	Chiller Load (Ton) 290.7 290.7	Chiller Demand (kW) 290.4 285.0 280.6	Storage Capacity (Ton-Hr) 1,049 1,215 1,385
1 2 3 4	OADB (F) 79.5 77.5 75.7 74.4	OAWB (F) 63.5 62.1 61.1 60.2	Cooling Load (Ton) 128.2 122.5 117.3 113.0	Chiller Load (Ton) 290.7 290.7 290.7 290.7	ekday Chiller Demand (kW) 290.4 285.0 280.6 278.2	Storage Capacity (Ton-Hr) 996 1,164 1,337 1,515	Cooling Load (Ton) 131.6 125.5 120.0 115.4	Chiller Load (Ton) 290.7 290.7 290.7	Chiller Demand (kW) 290.4 285.0 280.6 278.2	Storage Capacity (Ton-Hr) 1,049 1,215 1,385 1,561
1 2 3 4 5	OADB (F) 79.5 77.5 75.7 74.4 73.6	OAWB (F) 63.5 62.1 61.1 60.2	Cooling Load (Ton) 128.2 122.5 117.3 113.0 109.3	Chiller Load (Ton) 290.7 290.7 290.7 290.7	ekday Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1	Storage Capacity (Ton-Hr) 996 1,164 1,337 1,515 1,696	Cooling Load (Ton) 131.6 125.5 120.0 115.4 111.6	Chiller Load (Ton) 290.7 290.7 290.7 290.7	Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1	Storage Capacity (Ton-Hr) 1,049 1,215 1,385 1,561 1,740
1 2 3 4 5 6	OADB (F) 79.5 77.5 75.7 74.4 73.6 73.4	OAWB (F) 63.5 62.1 61.1 60.2 60.9	Cooling Load (Ton) 128.2 122.5 117.3 113.0 109.3 106.8	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 290.7	ekday Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0	Storage Capacity (Ton-Hr) 996 1,164 1,337 1,515 1,696 1,880	Cooting Load (Ton) 131.6 125.5 120.0 115.4 111.6	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 290.7	Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0	Storage Capacity (Ton-Hr) 1,049 1,215 1,385 1,561 1,740 1,921
1 2 3 4 5 6 7	OADB (F) 79.5 77.5 75.7 74.4 73.6 73.4 73.9	OAWB (F) 63.5 62.1 61.1 60.2 60.9 61.6 62.1	Cooling Load (Ton) 128.2 122.5 117.3 113.0 109.3 106.8 105.4	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 290.7	ekday Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 209.3	Storage Capacity (Ton-Hr) 996 1,164 1,337 1,515 1,696 1,880 2,000	Cooting Load (Ton) 131.6 125.5 120.0 115.4 111.6 109.2 107.6	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 186.3	Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 161.8	Storage Capacity (Ton-Hr) 1,049 1,215 1,385 1,561 1,740 1,921 2,000
1 2 3 4 5 6 7 8	79.5 77.5 75.7 74.4 73.6 73.4 73.9	OAWB (F) 63.5 62.1 61.1 60.2 60.9 61.6 62.1 61.8	Cooling Load (Ton) 128.2 122.5 117.3 113.0 109.3 106.8 105.4 114.7	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 290.7 290.7	ekday Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 209.3 0.0	Storage Capacity (Ton-Hr) 996 1,164 1,337 1,515 1,696 1,880 2,000 1,885	Cooling Load (Ton) 131.6 125.5 120.0 115.4 111.6 109.2 107.6 108.0	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 186.3 0.0	Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 161.8 0.0	Storage Capacity (Ton-Hr) 1,049 1,215 1,385 1,561 1,740 1,921 2,000 1,892
1 2 3 4 5 6 7 8	OADB (F) 79.5 77.5 75.7 74.4 73.6 73.4 73.9 75.4 77.9	63.5 62.1 61.1 60.2 60.9 61.6 62.1 61.8 62.6	Cooling Load (Ton) 128.2 122.5 117.3 113.0 109.3 106.8 105.4 114.7	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 290.7 290.7	ekday Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 209.3 0.0	Storage Capacity (Ton-Hr) 996 1,164 1,337 1,515 1,696 1,880 2,000 1,885 1,740	Cooling Load (Ton) 131.6 125.5 120.0 115.4 111.6 109.2 107.6 108.0 110.5	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 186.3 0.0	Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 161.8 0.0	Storage Capacity (Ton-Hr) 1,049 1,215 1,385 1,561 1,740 1,921 2,000 1,892 1,781
1 2 3 4 5 6 7 8 9	OADB (F) 79.5 77.5 75.7 74.4 73.6 73.4 73.9 75.4 77.9 80.9	63.5 62.1 61.1 60.2 60.9 61.6 62.1 61.8 62.6 63.8	Cooling Load (Ton) 128.2 122.5 117.3 113.0 109.3 106.8 105.4 114.7 145.7	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 290.7 290.7 0.0	ekday Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 209.3 0.0 0.0	Storage Capacity (Ton-Hr) 996 1,164 1,337 1,515 1,696 1,880 2,000 1,885 1,740 1,580	Cooting Load (Ton) 131.6 125.5 120.0 115.4 111.6 109.2 107.6 108.0 110.5 115.3	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 186.3 0.0 0.0	Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 161.8 0.0 0.0	Storage Capacity (Ton-Hr) 1,049 1,215 1,385 1,561 1,740 1,921 2,000 1,892 1,781 1,666
1 2 3 4 5 6 7 8 9 10	OADB (F) 79.5 77.5 75.7 74.4 73.6 73.4 73.9 75.4 77.9 80.9 84.3	63.5 62.1 61.1 60.2 60.9 61.6 62.1 61.8 62.6 63.8 64.4	Cooling Load (Ton) 128.2 122.5 117.3 113.0 109.3 106.8 105.4 114.7 145.7 159.4 174.5	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 290.7 290.7 0.0	ekday Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 209.3 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 996 1,164 1,337 1,515 1,696 1,880 2,000 1,885 1,740 1,580 1,406	Cooling Load (Ton) 131.6 125.5 120.0 115.4 111.6 109.2 107.6 108.0 110.5 115.3 121.9	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 186.3 0.0 0.0	Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 161.8 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 1,049 1,215 1,385 1,561 1,740 1,921 2,000 1,892 1,781 1,666 1,544
1 2 3 4 5 6 7 8 9 10 11	OADB (F) 79.5 77.5 75.7 74.4 73.6 73.4 73.9 75.4 77.9 80.9 84.3 87.6	63.5 62.1 61.1 60.2 60.9 61.6 62.1 61.8 62.6 63.8 64.4 65.8	Cooling Load (Ton) 128.2 122.5 117.3 113.0 109.3 106.8 105.4 114.7 145.7 159.4 174.5	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 290.7 290.7 200.0 0.0	ekday Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 209.3 0.0 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 996 1,164 1,337 1,515 1,696 1,880 2,000 1,885 1,740 1,580 1,406 1,218	Cooling Load (Ton) 131.6 125.5 120.0 115.4 111.6 109.2 107.6 108.0 110.5 115.3 121.9 129.1	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 186.3 0.0 0.0 0.0	Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 161.8 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 1,049 1,215 1,385 1,561 1,740 1,921 2,000 1,892 1,781 1,666 1,544 1,415
1 2 3 4 5 6 7 8 9 10 11 12	OADB (F) 79.5 77.5 75.7 74.4 73.6 73.4 73.9 75.4 77.9 80.9 84.3 87.6 90.7	63.5 62.1 61.1 60.2 60.9 61.6 62.1 61.8 62.6 63.8 64.4 65.8 66.9	Cooling Load (Ton) 128.2 122.5 117.3 113.0 109.3 106.8 105.4 114.7 145.7 159.4 174.5 187.7	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 290.7 290.7 200.0 0.0 0.0 0.0 0.0 0.0	ekday Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 209.3 0.0 0.0 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 996 1,164 1,337 1,515 1,696 1,880 2,000 1,885 1,740 1,580 1,406 1,218 1,023	Cooling Load (Ton) 131.6 125.5 120.0 115.4 111.6 109.2 107.6 108.0 110.5 115.3 121.9 129.1 135.7	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 186.3 0.0 0.0 0.0 0.0 0.0	Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 161.8 0.0 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 1,049 1,215 1,385 1,561 1,740 1,921 2,000 1,892 1,781 1,666 1,544 1,415 1,280
1 2 3 4 5 6 7 8 9 10 11	OADB (F) 79.5 77.5 75.7 74.4 73.6 73.4 73.9 75.4 77.9 80.9 84.3 87.6	63.5 62.1 61.1 60.2 60.9 61.6 62.1 61.8 62.6 63.8 64.4 65.8	Cooling Load (Ton) 128.2 122.5 117.3 113.0 109.3 106.8 105.4 114.7 145.7 159.4 174.5 187.7	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 290.7 290.7 200.0 0.0	ekday Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 209.3 0.0 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 996 1,164 1,337 1,515 1,696 1,880 2,000 1,885 1,740 1,580 1,406 1,218	Cooling Load (Ton) 131.6 125.5 120.0 115.4 111.6 109.2 107.6 108.0 110.5 115.3 121.9 129.1	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 186.3 0.0 0.0 0.0	Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 161.8 0.0 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 1,049 1,215 1,385 1,561 1,740 1,921 2,000 1,892 1,781 1,666 1,544 1,415
1 2 3 4 5 6 7 8 9 10 11 12	OADB (F) 79.5 77.5 75.7 74.4 73.6 73.4 73.9 75.4 77.9 80.9 84.3 87.6 90.7	63.5 62.1 61.1 60.2 60.9 61.6 62.1 61.8 62.6 63.8 64.4 65.8 66.9	Cooling Load (Ton) 128.2 122.5 117.3 113.0 109.3 106.8 105.4 114.7 145.7 159.4 174.5 187.7	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 290.7 290.7 200.0 0.0 0.0 0.0 0.0 0.0	ekday Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 209.3 0.0 0.0 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 996 1,164 1,337 1,515 1,696 1,880 2,000 1,885 1,740 1,580 1,406 1,218 1,023	Cooling Load (Ton) 131.6 125.5 120.0 115.4 111.6 109.2 107.6 108.0 110.5 115.3 121.9 129.1 135.7	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 186.3 0.0 0.0 0.0 0.0 0.0	Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 161.8 0.0 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 1,049 1,215 1,385 1,561 1,740 1,921 2,000 1,892 1,781 1,666 1,544 1,415 1,280
1 2 3 4 5 6 7 8 9 10 11 12	OADB (F) 79.5 77.5 75.7 74.4 73.6 73.4 73.9 75.4 77.9 80.9 84.3 87.6 90.7 93.1	63.5 62.1 61.1 60.2 60.9 61.6 62.1 61.8 62.6 63.8 64.4 65.8 66.9	Cooling Load (Ton) 128.2 122.5 117.3 113.0 109.3 106.8 105.4 114.7 145.7 159.4 174.5 187.7 194.5 201.0	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 290.7 290.0 0.0 0.0 0.0 0.0 0.0	ekday Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 209.3 0.0 0.0 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 996 1,164 1,337 1,515 1,696 1,880 2,000 1,885 1,740 1,580 1,406 1,218 1,023	Cooling Load (Ton) 131.6 125.5 120.0 115.4 111.6 109.2 107.6 108.0 110.5 115.3 121.9 129.1 135.7 142.2	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 186.3 0.0 0.0 0.0 0.0 0.0	Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 161.8 0.0 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 1,049 1,215 1,385 1,561 1,740 1,921 2,000 1,892 1,781 1,666 1,544 1,415 1,280
1 2 3 4 5 6 7 8 9 10 11 12 13 14	OADB (F) 79.5 77.5 75.7 74.4 73.6 73.4 73.9 75.4 77.9 80.9 84.3 87.6 90.7 93.1	63.5 62.1 61.1 60.2 60.9 61.6 62.1 61.8 62.6 63.8 64.4 65.8 66.9 67.6	Cooling Load (Ton) 128.2 122.5 117.3 113.0 109.3 106.8 105.4 114.7 145.7 159.4 174.5 187.7 194.5 201.0	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 290.7 290.0 0.0 0.0 0.0 0.0 0.0	ekday Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 209.3 0.0 0.0 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 996 1,164 1,337 1,515 1,696 1,880 2,000 1,885 1,740 1,580 1,406 1,218 1,023 822	Cooling Load (Ton) 131.6 125.5 120.0 115.4 111.6 109.2 107.6 108.0 110.5 115.3 121.9 129.1 135.7	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 186.3 0.0 0.0 0.0 0.0 0.0	Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 161.8 0.0 0.0 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 1,049 1,215 1,385 1,561 1,740 1,921 2,000 1,892 1,781 1,666 1,544 1,415 1,280 1,137
1 2 3 4 5 6 7 8 9 10 11 12 13 14	OADB (F) 79.5 77.5 75.7 74.4 73.6 73.4 73.9 75.4 77.9 80.9 84.3 87.6 90.7 93.1	63.5 62.1 61.1 60.2 60.9 61.6 62.1 61.8 62.6 63.8 64.4 65.8 66.9 67.6	Cooling Load (Ton) 128.2 122.5 117.3 113.0 109.3 106.8 105.4 114.7 145.7 159.4 174.5 187.7 194.5 201.0	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 290.7 290.0 0.0 0.0 0.0 0.0 0.0 0.0	ekday Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 209.3 0.0 0.0 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 996 1,164 1,337 1,515 1,696 1,880 2,000 1,885 1,740 1,580 1,406 1,218 1,023 822	Cooling Load (Ton) 131.6 125.5 120.0 115.4 111.6 109.2 107.6 108.0 110.5 115.3 121.9 129.1 135.7 142.2	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 186.3 0.0 0.0 0.0 0.0 0.0	Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 161.8 0.0 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 1,049 1,215 1,385 1,561 1,740 1,921 2,000 1,892 1,781 1,666 1,544 1,415 1,280 1,137
1 2 3 4 5 6 7 8 9 10 11 12 13 14	OADB (F) 79.5 77.5 75.7 74.4 73.6 73.4 73.9 75.4 77.9 80.9 84.3 87.6 90.7 93.1	63.5 62.1 61.1 60.2 60.9 61.6 62.1 61.8 62.6 63.8 64.4 65.8 66.9 67.6	Cooling Load (Ton) 128.2 122.5 117.3 113.0 109.3 106.8 105.4 114.7 145.7 159.4 174.5 187.7 194.5 201.0	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 290.7 290.0 0.0 0.0 0.0 0.0 0.0 0.0	ekday Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 209.3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 996 1,164 1,337 1,515 1,696 1,880 2,000 1,885 1,740 1,580 1,406 1,218 1,023 822 616 405 217	Cooling Load (Ton) 131.6 125.5 120.0 115.4 111.6 109.2 107.6 108.0 110.5 115.3 121.9 129.1 135.7 142.2	Chiller Load (Ton) 290.7 290.7 290.7 290.7 290.7 186.3 0.0 0.0 0.0 0.0 0.0 0.0	Chiller Demand (kW) 290.4 285.0 280.6 278.2 279.1 280.0 161.8 0.0 0.0 0.0 0.0 0.0 0.0 0.0	Storage Capacity (Ton-Hr) 1,049 1,215 1,385 1,561 1,740 1,921 2,000 1,892 1,781 1,666 1,544 1,415 1,280 1,137

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

COLD #HERMAL STORAGE - ALTERNATIVE 1

								Saturday			
	Typical Cooling Chiller Chiller Storage								•		
	• • •	oical				Storage	•	Chiller		Storage	
	CADB	OAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity	
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)	
18	94.1	67.9	173.4	0.0	0.0	43	155.9	0.0	0.0	527	
19	92.8	67.8	166.1	290.7	320.2	168	157.1	290.7	320.2	660	
20	91.0	66.7	155.4	290.7	315.4	303	154.9	290.7	315.4	796	
21	89.0	66.7	150.3	290.7	311.8	443	151.8	290.7	311.8	935	
22	86.7	66.5	146.8	290.7	307.4	587	148.3	290.7	307.4	1,077	
23	84.3	66.1	142.4	290.7	302.6	736	143.9	290.7	302.6	1,224	
24	81.8	65.0	136.1	290.7	296.6	890	137.6	290.7	296.6	1,377	
				S	tundov ana			¥	londay		
	Tra	pical		Chiller	•	Storage		Chiller	•	Storage	
	OADB	OAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity	
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)	
noui	(1)	(1)	(1011)	(1011)	(~~)	(1011 111)	(,	(10.0)	4	••••••	
1	79.5	63.5	131.5	290.7	290.4	1,536	130.0	290.7	290.4	1,538	
2	77.5	62.1	125.5	290.7	285.0	1,702	123.9	290.7	285.0	1,705	
3	75.7	61.1	119.9	290.7	280.6	1,872	118.4	290.7	280.6	1,877	
4	74.4	60.2	115.3	242.9	226.4	2,000	113.8	236.7	219.6	2,000	
5	73.6	60.9	111.6	111.6	81.7	2,000	110.0	110.0	80.6	2,000	
6	73.4	61.6	109.2	109.2	80.5	2,000	107.6	107.6	79.3	2,000	
7	73.9	62.1	107.6	107.6	79.6	2,000	106.0	106.0	78.5	2,000	
8	75.4	61.8	108.0	0.0	0.0	1,892	115.1	0.0	0.0	1,885	
9	77.9	62.6	110.5	0.0	0.0	1,781	146.0	0.0	0.0	1,739	
10	80.9	63.8	115.3	0.0	0.0	1,666	159.6	0.0	0.0	1,579	
11	84.3	64.4	121.9	0.0	0.0	1,544	174.6	0.0	0.0	1,405	
12	87.6	65.8	129.1	0.0	0.0	1,415	187.8	0.0	0.0	1,217	
13	90.7	66.9	135.7	0.0	0.0	1,280	194.6	0.0	0.0	1,022	
14	93.1	67.6	142.2	0.0	0.0	1,137	201.0	0.0	0.0	821	
15	94.6	68.3	147.9	0.0	0.0	989	206.7	0.0	0.0	615	
16	95.1	68.6	152.0	0.0	0.0	837	211.0	0.0	0.0	404	
17	94.9	68.4	154.9	0.0	0.0	683	188.4	0.0	0.0	215	
18	94.1	67.9	155.9	0.0	0.0	527	173.4	0.0	0.0	42	
19	92.8	67.8	157.1	290.7	320.2	660	166.1	290.7	320.2	166	
20	91.0	66.7	154.9	290.7	315.4	796	155.5	290.7	315.4	302	
21	89.0	66.7	151.8	290.7	311.8	935	150.3	290.7	311.8	442	
22	86.7	66.5	148.3	290.7	307.4	1,077	146.8	290.7	307.4	586	
23	84.3	66.1	143.9	290.7	302.6	1,224	142.4	290.7	302.6	734	
24	81.8	65.0	137.6	290.7	296.6	1,377	136.1	290.7	296.6	889	

Thermal Energy Storage Systems

a comprehensive one-day seminar on the technologies

PSI Energy 1000 East Main Street Plainfield, Indiana 46168

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and

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Thermal Storage Applications Research Ce

Thermal Storage Technology Overview

Theoretical Storage Volume Requirements

Presently, these are three different types of media for storing thermal energy in a cool storage system: ice, salt hydrates and water. The first two undergo a change of phase while storing or releasing heat energy. The third, water, does not.

Each storage media requires some inherent volume and mass for storing heat energy. If one could neglect circulation space and assume 100% storage utilization, the theoretical storage volumes would be:

1.46 ft³/ton-hour

ce:

salt hydrate: 3.18 ft³/ton-hour

water: 9.62 ft³/ton-hour

The figures shown for ice and salt storage are based upon latent heat capacity only. The figure for water is based upon a 20° change in storage temperature, from 40° to 60° .

These storage volumes are theoretical only. They are not obtainable in the field for several reasons. First, it is necessary to allocate some of the storage volume for internal circulation of fluid for heat transfer. While some manufacturers would like to have us believe otherwise, no thermal storage system is 100% efficient. Not all internal energy is completely usable. These factors result in actual storage volumes considerably above these figures. For example, these have become commonly accepted:

ice: 2.25 to 3.00 ft³/ton-hour

salt hydrate: 5.50 to 6.00 ft³/ton-hour

water: 12.50 to 13.00 ft³/ton-hour

The lower value for ice storage represents a typical value for an encapsulated ice storage vessel; the higher value is for an ice harvester system.

Storage volumes often do not represent the actual storage "floor space" required. Many manufacturers build their systems in round or cylindrical tanks. In these cases, the required floor space is something above the "footprint" of a storage vessel, depending upon whether it is oriented in a horizontal or vertical configuration. Some amount of space is needed for access, however this often is quite minimal since very little if any servicing to the storage itself is ever needed. Some manufacturers' systems can be directly buried if the vessels are built to accommodate this.

were installed vertically, the space requirement would be about 0.063 ft²/ton-hour. This is usually, as mentioned before, not possible unless the tank is outdoors. If installed horizontally, the storage vessel space requirement becomes 0.237 ft²/ton-hour.

A normal required area range for vertical tanks is 0.063²/ton-hour for a 45 ft high tank to 0.12² for a 25 high tank. Horizontal tanks will need an area of approximately 0.235 to 0.238 ft²/ton hour.

Chilled Water Storage Systems

Chilled water storage systems are really nothing more than a tank of cold water held as close to 40° as possible. Why 40° ? Because at this temperature, water is at its greatest density (this actually occurs at 39.2° , but 40° has become the standard minimum design temperature).

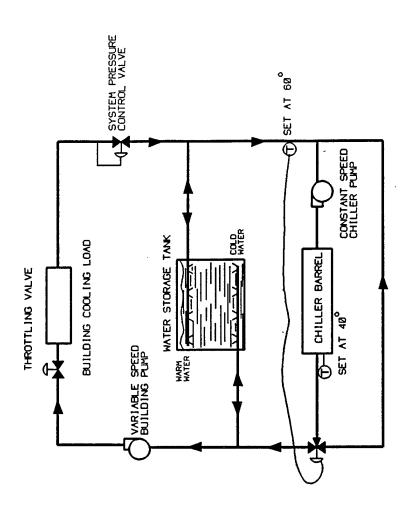
Many chilled water storage systems have been built. Extensive research has been done, and some very fine publications have come out of this effort, most notably that from EPRI. EPRI's publication EM 4852, Stratified Chilled Water Storage Design Guide is probably the most authoritative of all publications thus far. Research has proven that of all storage methods, a single stratified storage tank has the greatest reliability and at the lowest cost.

There is one important consideration about stratified water systems that one must keep in mind. Water returning from the building air-handling unit (cooling coil) MUST always return at a constant temperature (or very close to it). One may deduce from this statement that water flow rates are not constant, but variable. Hence this system would imply variable speed pumping. The only exception to this is the water flow circuit through the chiller itself, which is constant flow. Flow to the building is variable as is flow to the storage tank. Three-way valves on cooling coils cannot be used. If retrofitting an existing system, and it has three way valves, simply close off the bypass ports and cap them.

When retrofitting an existing air handling unit, check to see that it has a chilled water coil of at least 6 rows of tubing with 14 fins per inch. Eight rows are highly recommended. If the coil bank has less than 6 rows, add an additional cooling coil piped in series with the existing coil. If this is not possible, use another cool storage technology.

Manufacturers of stratified chilled water tanks are:

- CBI (Chicago Bridge & Iron Company Stratatherm Div.)
- General Engineering Corp.
- Van Doren Industries



Space Requirements

the overall tank utilization efficiency. Because insulation Depths greater than 12 ft are possible, but add little to The optimum storage tank for a stratified chilled water design the tank so that total surface area is minimized while holding the minimum tank depth to 12 feet as of a water storage tank is so important, it is wise to system is a round tank, no less than 12 feet deep. mentioned before.

depth and a 90% tank utilization, the required surface Based upon 6" of insulation on top and sides, a 12 ft area will range between 1.043 ft² to 1.05 ft² per ton-hour. This area is for a rectangular tank.

a change in its phase during the heat transfer process is a phase change material" - any substance that undergoes technology, except a higher temperature phase-change material (PCM) is used. (Note the used of the term definition, when its goes from its liquid to solid phases. phase change material. For example, water meets this This concept is quite similar to the encapsulated ice In so doing, its absorbs 144 btu/lb in the process.) Salt Hydrate Systems
This 7

storage medium. One freezes at 47°, the other at 41°. In a salt hydrate system, a proprietary salt mixture is phase-change temperatures, can be selected as the used. Two types of salts, each having difference



Demand & Energy of Thermal Storage Technologies⁽¹⁾

		- TO STORA	AGE			TO LOAD	AD	
	PEAK DAY, KW/TON	/ION	SEASONAL, KWh/TON-HR	TON-HR	PEAK DAY, KW/TON	쾨	SEASONAL, KWh/TON-HR	h/TON-HR
TECHNOLOGY	OJ	Ī	01	王	01	王	01	H
CHILLED WATER STORAGE ⁽³⁾ 1.00	1.00	1.10	0.75	0.95	0.95	1.05	0.65	0.95
SALT HYDRATE ⁽³⁾	0.85	1.10	0.65	0.95	0.95	1.05	0.65	0.95
ICE HARVESTER ⁽²⁾	0,95	1.50	0.80	1.10	0.75	0.95	0.50	0.95
B&R ICE ⁽³⁾⁽⁵⁾	1.00	1.60	0.95	1.25	0.95	1.05	0.65	0.80

⁽¹⁾ All figures include allowances for condenser or cooling tower fans, condenser and chilled water pump(s). "LO" figures are for evaporative-cooled equipment; "H" figures are for water-cooled equipment. If air-cooled equipment is used, multiply ranges shown by 1.35.

^{[2] &}quot;LO" figures are for systems with refrigerant liquid overfeed, hi-side drainers and screw compressors with floating head pressure - see text. [2] Water-cooled chillers, either reciprocating, screw or centrifugal, with constant condenser water inlet temperatures will exhibit values 1.5 to 2.5 times figures shown.

⁽⁴⁾ On-peak demand for load shifting systems will range between 0.03 to 0.05 kW/ton for operation of chilled water pump(s).

⁽⁵⁾ B&R Ice = Brine & Refrigerant Ice

Costs of Thermal Storage Systems

\$/TON-HOUR	\$60-\$85 (An average of \$175 == ,5 (
CONCEPI	chilled water

harvester \$125 - \$145

salt hydrate \$120 brine/refg ice \$65 - \$100

With the exception of the ice harvester, the balance of these concepts do not include cost for a refrigeration plant. The harvester does. The harvester system is a completely packaged unit and includes a storage tank.

All costs assume an "easy" installation, the storage system located immediately adjacent an outside equipment room wall.

	JOB WSMR E	505 STUBY #1110-000
E M C ENGINEERS, INC.	SHEET NO.	
Denver • Colorado Springs • Atlanta • Germany	CALCULATED BY	F DATE 4/03/92
Doniel Golorade opinige Piliana donnany	CHECKED BY	DATE
P300 THERMAL STORAGE ECO	SCALE	

DEMAND SHIFT CALCULATIONS

WITH THE STORAGE, ALL CHILLER EQUIPMENT WILL OPERATE
DURING THE OFF PEAK PERIOD EXCEPT THE CHILLED
WATER PUMPS, FROM THE TRACE GOD THERMAL STORAGE
COMPUTER REPORT, THE FOLLOWING KW LOADS WILL BE
SHIFTED.

LW (SUM OF MONTHLY DEMANDS)

Z STARE CHILLER

1353.3

COULING TOWER

225.7

COND. WATER PUMPS

134.4

CHILLER CONTROLS

12.3

ARR-COOLED CHILLER

384.4

CONTROLS

0.9

AVERAGE MONTHLY LW SHIFT = 2030.7 = 169KW

ANNUAL DEMAND SAVINGS = 2030.7 X\$19,50=\$39,599

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION: Whit	te Sands Missil	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	BLDG. 300 -	VARIABLE AIR VOLUME	SYSTEMS ON AHUS		FISCAL YEAR:	1992
		DISCRETE PORTIC	ON NAME:	TOTAL				
		ANALYSIS DATE:	07/13/92		ECONOMIC LIFE:	15	PREPARED BY:	A. NIEMEYER
1	iN۱	VESTMENT						
	A.	CONSTRUCTION	COST				\$268,913	
	В.	SIOH COST		(5.5% of 1A) =			\$14,790	
	C.	DESIGN COST		(6.0% of 1A) =			\$16,135	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$299,838	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D – 1E) =			 >	\$299,838
2	EN	IERGY SAVINGS (+)	• •					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
		ELEC	\$6.48	4,108	\$26,597	10.79	\$286,980	
		DIST		0	\$0	11.57	\$0	
		NAT GAS	\$2.21	770	\$1,704	12.38	\$21,090	
		PAPER		0	\$0		\$0	
		COAL			\$0	11.35	\$0	
	F.	TOTAL		4,878	28,300.4		>	\$308,070
•	NO	NI FUEDOV ON AN	100 (.) (000T					
3		N-ENERGY SAVIN					***	
	A.			C. DEMAND SAVINGS)	(Farm Table 4.0)	10.00	\$21,333	
		1 DISCOUNT FAC		COST ()	(From Table A-2) =	10.67	****	
		2 DISCOUNTED S		.OS1 (-)	(3A x 3A1) =		\$227,623	
	Ь.	ITEM	a (+/-)		YEAR OF	DISCOUNT	DISCOUNTED	
		11 CIVI		SAVINGS (1)	OCCURRENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS (4)	
		a.		\$0	OCCORNENCE (2)	0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0		0.00	\$0	
	C.		RGY DISCOUN	NTED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =	40	\$227,623
		PROJECT NON-E				(6.2.4.321.4)		
		1 25% MAXIMUM		Y CALCULATION		(2F5 x 0.33) =	\$101,663	
		a IF 3D1 => 3C 7	THEN GO TO 4	,		(, _ , _ , _ , _ , _ , _ , _ , _ , _ ,	******	
		b IF 3D1 < 3C TI	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =	1.37	
		c IF 3D1b => 1 T	THEN GO TO 4			,		
		d F3D1b < 1 Th	HEN PROJECT	DOES NOT QUALIFY				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$49,633
5	то	TAL NET DISCOUN	ITED SAVINGS	3		(2F5 + 3C) =		\$535,693
6	DIS	SCOUNTED SAVING	3S-TO-INVES	TMENT RATIO (SIR)		(5/1F) =		1.79
	(II	F SIR < 1 THEN PRO	OJECT DOES I	NOT QUALIFY)				
7	SIN	MPLE PAYBACK (SP	PB)			(1F/4) =		6.04

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NMO							
CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SOL	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO	ORTH BLVI)., #C-200, I	DENVER, CC) 80227	
CONTRACT F	CONTRACT FOR (Work to be performed) VARIABLE AIR VOLUME SYSTEMS ON AHUS - BLDG 3	Js – BLDG	300				PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WHITE SANDS MISSILE	RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	L cost		LABOR COSTS			
Line	ltem .	of life	Quantity			Manhours	Average		Other Direct	Line
Š.	ε	Measure (2)	ම	Unit (4)	Total (5)	Mandays (6)	Rate (7)	Total (8)	Costs (9)	Total (10)
	Main Building, West Addition, and East Addition									
	Remove Existing Mixing Boxes & Thermostats	EA	74			2.00	20.58	3045.84		\$3,045.84
	Install Variable Frequency Drives - Main Bldg.	EA	3	14486	43458	50.00	27.60	4140.00		\$47,598.00
	Install Variable Frequency Drives - West Addition	EA	2	5444	10888	40.00	27.60	2208.00		\$13,096.00
D1'	Install Variable Frequency Drives - East Addition	E	2	7073	14145	40.00	27.60	2208.00		\$16,353.00
	Install Balancing Dampers on SZ AHU ductwork	E	12	\$	768.75	6.00	27.60	1987.20		\$2,755.95
	Dual Duct VAV Mixing Boxes	EA	74	563	41625	3.00	27.63	6133.86		\$47,758.86
	VAV Box Controls: DDC Controllers	EA	74	449	33207.5	2.00	27.60	4084.80		\$37,292.30
	Velocity Sensors	EA	74	125	9250	1.00	27.60	2042.40		\$11,292.40
	VAV Box Actuators	ā	74	8	6937.5	1.00	27.60	2042.40		\$8,979.90
	Space Temperature Sensors	EA	74	83	4625	1.00	27.60	2042.40		\$6,667.40
	Sensor Wiring	5	3700	0.31	1156.25	90.0	27.60	6127.20		\$7,283.45
	Power Wiring & Conduit	5	3700	0.71	2636.25	0.08	27.60	8169.60		\$10,805.85
i	Subtotal									\$212,929
	Source: Means Electric & Mechanical Cost Data, 1992; Denver Electric Motor Sales & Service;	tor Sales & Service	s; Material costs i	nclude 25% over	Material costs include 26% overhead & profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1	cource: U.S. Dept. o	f Labor, General Wa	ge Decision No. NM9	1-1	

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKD(NMC							
CONTRACTOR	лон EMC ENGINEERS INC.			ADDRESS 2750 SO	UTH WADSW	ORTH BLV	D., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO	O 80227	
CONTRAC	CONTRACT FOR (Work to be performed) VARIABLE AIR VOLUME SYSTEMS ON AHUS - BLDG 300	Js – BLDG	300				PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
PURCHAS	PURCHASE REQUEST NUMBER			PROJECT NUMBER	ABER		WORK LOCATION WHITE SAN	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
				MATER	MATERIAL COST		LABOR COSTS			
Line	Item	of Crit	Quantity			Manhours	Average		Other Direct	Line
N	(1)	Measure (2)	(3)	Unit (4)	Total (5)	Mandays (6)	Rate (7)	Total (8)	Costs (9)	Total (10)
	Main Bldg, West Addition, and East Addition (cont')									
	AHU Controls: Remote Control Units	Ē	7	1125	7875	8.00	27.60	1545.60		\$9,420.60
·	Pressure Sensor Wiring	J)	1400	0.31	437.5	0.08	27.60	3091.20		\$3,528.70
	Pressure Sensors	EA	7	250	1750	2.00	27.60	386.40		\$2,136.40
D12-	Control Programming	EA	က			8.00	50.00	1200.00		\$1,200.00
3	Field Test of Control System	EA	3			8.00	27.63	663.12		\$663.12
	Check Air Flow on AHUs	EA	7			12.00	27.63	2320.92		\$2,320.92
	Check Max. and Min. Air Flow on VAV Boxes	EA	74			6.00	27.63	12267.72		\$12,267.72
	Subtotal									\$244,466
	Contingency (10%)									\$24,447
	TOTAL									\$268,913
	Source: Means Electric & Mechanical Cost Data, 1992; Denver Electric Motor Sales & Service; Material costs include 25% overhead & profit; Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1	or Sales & Service	; Material costs in	clude 25% overl	nead & profit; Labor So	ource: U.S. Dept. of	Labor, General Wa	ge Decision No. NM91	-1	•

D12-3

HITACHI ADJUSTABLE FREQUENCY **CONTROL**

Rec'd 1/10/92 AN DEUS ON

OHITACHI

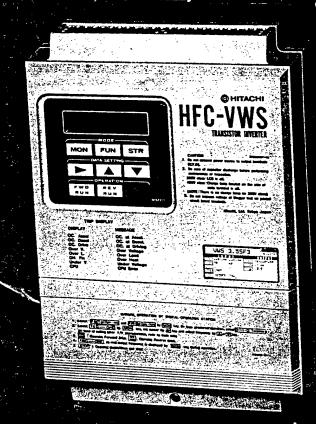
LD3U LF3U (HF3U)



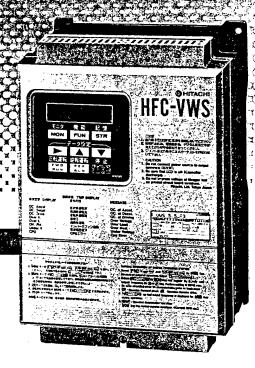
DENVER ELECTRIC MOTOR

Sales & Service, Inc.

1300 E. 58th Avenue Denver, Colorado 80216 1-303-292-9133 FAX 1-303-297-1707



Occurrence and Lower Noise:



HEC-VWS SERIES

▼ THREE PHASE, 200 V CLASS

- MODEL NAME	1.5LD3	, 2.5LD3	3.5LD3*
*APPLICABLE MOTOR (4P, kW)	0.75	1.5	2.2

MODEL NAME	5.5173	₹8LF3	11153	16LF3	2213		40LF3	50LF3	60LF3	, 75LF3
*APPLICABLE MOTOR (4P, kW)	3.7	5.5	7.5	11	15	18.5, 22	30	37	45	55

▼ THREE PHASE, 400 V CLASS

MODEL NAME 28	2.5HF3	3.5HE	. 5.5HF3*	(SH8)		्राग्राहः	721 E -7	- 33HE	40HF3	250HF3
*APPLICABLE MOTOR (4P, kW)	1.5	2.2	3.7	5.5	7.5	11	15	18.5, 22	30	37

MODEL NAME	60HF3	75H3)	\$100H3	120HF3	धार्मि	180H2)
*APPLICABLE MOTOR (4P, kW)	45	55	75	90	110	150

^{*}Applicable motors are indicated according to the characteristics of Hitachi standard three phase 4 pole motors.

(Description of Type Symbol)

HFC-VWS 5.5HF3UH

Ground fault protection

H: factory ground fault equipped None: (less factory ground fault)

U.S.A. version

Version number

Digital display panel

Input voltage [L: three phase, 200 V class H: three phase, 400 V class

Output capacity (kVA)

Function and application (S: standard type)

Output waveform (W: PWM control system)

Control system (V: voltage source type)

D12-5





TECO AMERICAN INC.

Fire ANDERSON EFFECTIVE 4-1-90 (SUPERSEDES: NEW)



HFC-VWS-3 INVERTER LIST PRICES

200v Class

ZUUY CIASS						γ	1	
CATALOG	Output	230V	Typical	DIMENS	SIONS-INCHES	S (cm)	Approx Wt.	LIST
NUMBER HFC-VWS-	kVA	rms amps	motor hp	Height	Width	Depth	Lb (kg)	PRICE
1.5 LD 3 UH	2.0	5	1	11.8 (30)	8.7 (22)	5.5 (14)	10 (4.5)	\$ 888.00
2.5 LD 3 UH		7.5	2	11.8 (30)	8.7 (22)	6.9 (17.5)	11.5 (5.2)	1,000.00
3.5 LD 3 UH		10.5	3	11.8 (30)	8.7 (22)	6.9 (17.5)	13 (6.0)	1,111.00
5.5 LF 3 UH		16.5	5	11.8 (30)	8.7 (22)	6.9 (17.5)	14 (6.5)	1,333.00
8 LF3UH		24	7.5	17.3 (44)	9.8 (25)	7.7 (19.5)	26.5 (12.0)	2,000.00
11 LF 3 UH		32	10	17.3 (44)	9.8 (25)	7.7 (19.5)	30 (13.5)	2,666.00
16 LF3 UF		46	15	17.3 (44)	9.8 (25)	7.7 (19.5)	31 (14.0)	3,555.00
22 LF 3 UF		64	20	17.7 (45)	12.8 (32.5)	9.5 (24)	48.5 (22.0)	4,444.00
33 LF3 U	37	95	30	19.7 (50)	15.4 (39)	10.6 (27)	57 (26.0)	5,888.00
40 LF3 U	48	121	40	24.4 (62)	15.4 (39)	10.6 (27)	66 (30.0)	8,111.00
50 LF 3 U	57	145	50	24.4 (62)	15.4 (39)	10.6 (27)	88 (40.0)	9,555.00
60 LF3U	72	182	60	31.5 (80)	18.9 (48)	10.6 (27)	128 (58.0)	11,111.00
75 LF 3 U	87	220	75	31.5 (80)	18.9 (48)	10.6 (27)	128 (58.0)	12,444.00
/5 LF3 U	01	220	1	1		<u> </u>		<u> </u>

400v Class

400V Class								
CATALOG	Output	460V	Typical	DIMENS	SIONS-INCHES	6 (cm)	Approx Wt.	LIST
NUMBER HFC-VWS-	kVA	rms amps	motor hp	Height	Width	Depth	Lb (kg)	PRICE
2.5 HF 3 UH	3.0	3.8	2	11.8 (30)	8.7 (22)	6.9 (17.5)	16.5 (7.5)	\$1,333.00
3.5 HF 3 UH	4.2	5.3	3	11.8 (30)	8.7 (22)	6.9 (17.5)	16.5 (7.5)	1,555.00
5.5 HF 3 UH	6.8	8.6	5	11.8 (30)	8.7 (22)	6.9 (17.5)	19 (8.5)	1,833.00
8 HF 3 UH	10	13	7.5	17.3 (44)	9.8 (25)	7.7 (19.5)	32 (14.5)	2,611.00
	12	16	10	17.3 (44)	9.8 (25)	7.7 (19.5)	33 (15)	3,277.00
	18	23	15	17.7 (45)	12.8 (32.5)	9.5 (24)	50 (22.5)	4,333.00
16 HF 3 UH	25	32	20	17.7 (45)	12.8 (32.5)	9.5 (24)	54 (24.5)	5,055.00
22 HF 3 UH		48	30	19.7 (50)	15.4 (39)	10.6 (27)	66 (30)	7,388.00
33 HF 3 U	38	58	40	24.4 (62)	15.4 (39)	10.6 (27)	88 (40)	8,777.00
40 HF3U	46	75	50	27.6 (70)	18.9 (48)	10.6 (27)	106 (48)	10,555.00
50 HF3U	59		60	27.6 (70)	18.9 (48)	10.6 (27)	124 (56)	12,000.00
60 HF3U	71	90	 	27.6 (70)	18.9 (48)	10.6 (27)	128 (58)	13,333.00
75 HF 3 U	87	110	75	41.7 (106)	21.7 (55)	11.8 (30)	232 (105)	17,555.00
100 HF3U	118	149	100	 	<u> </u>	11.8 (30)	232 (105)	19,333.00
120 HF3U	140	176	125	41.7 (106)	21.7 (55)		331 (150)	21,555.00
150 HF3U	172	217	150	51.2 (130)	21.7 (55)	11.8 (30)		27,444.00
180 HF 3 U	207	260	200	51.2 (130)	21.7 (55)	11.8 (30)	353 (160)	27,444.00

ESOS STUDY AT WSMR - BUILDING 300 WHITE SANDS MISSILE RANGE NM US ARMY EMC ENGINEERS, INC. RANGE CONTROL BLDG: ALT 1-BSLN, ALT2-ECO (DD-VAV)

Weather File Code: ELPASO.W

Location:

serior introduction

Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone:

Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg)

Summer Clearness Number: 1.00 1.00 Winter Clearness Number: Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20

Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft) Air Specific Heat: 0.2444 (Btu/lbm/F) Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)

Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft) Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: January To December System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 9:11: 6 3/16/92 300A .TM

Dataset Name:

D12-7

AIRFLOW - ALTERNATIVE 1

ECO - VAV ON AHUS - BUILDING 300

(Design Airflow Quantities)

				Main			Auxil.	Room
		Outside	Cooling	Heating	Return	Exhaust	Supply	Exhaust
System	System	Airflow						
Number	Type	(Cfm)						
1	DDVAV	907	12,959	4,501	13,282	1,230	0	0
2	DDVAV	1,522	21,569	4,502	21,893	1,845	0	0
3	DDVAV	3,209	45,229	10,696	46,216	4,196	0	0
Totals		5,639	79,757	19,699	81,390	7,272	0	0

CAPACITY - ALTERNATIVE 1
ECO - VAV ON AHUS - BUILDING 300

------ SYSTEM SUMMARY -------(Design Capacity Quantities)

Main Sys. Aux. Sys. Opt. Vent Cooling Main Sys. Aux. Sys. Preheat Reheat Humidif. Opt. Vent Heating System System Capacity Capacity Capacity Totals Capacity Capacity Capacity Capacity Capacity Capacity Totals Number Type (Tons) (Tons). (Tons) (Tons) (Btuh) - (Btuh) (Btuh) (Btuh) (Btuh) 1 DDVAV 26.4 0.0 0.0 26.4 -340,590 -25,286 0 0 -365,876 2 DDVAV 42.9 0.0 0.0 42.9 -420,206 -41,696 0 0 0 -461,902 3 DDVAV 93.1 93.1 -1,219,000 0.0 0.0 0 -86,523 0 0 0 -1,305,523 Totals 162.4 0.0 0.0 162.4 -1,979,796 0 -153,504 0 0 0 -2,133,300

The building peaked at hour 16 month 7 with a capacity of 162.4 tons

ENGINEERING CHECKS - ALTERNATIVE 1
ECO - VAV ON AHUS - BUILDING 300

000000

			Percent		Cool	ing		Heat	ing	
System	Main/	System	O utside	Cfm/	Cfm/	Sq Ft	Btuh/	Cfm/	Btuh/	Floor Area
Number	Auxiliary	Туре	Air	Sq Ft	Ton	/Ton	Sq Ft	Sq Ft	Sq Ft	Sq Ft
1	Main	DDVAV	7.00	1.07	490.0	456.2	26.31	0.37	-30.32	12,065
2	Main	DDVAV	7.06	1.79	502.7	281.2	42.67	0.37	-38.28	12,065
3	Main	DDVAV	7.09	1.23	486.0	394.5	30.42	0.29	-35.56	36,710

in all the state of the

Opt Vent

Total

0.0

-365.9

0

0.0

0.0

Rm Exh

Auxil

System 1 Block DDVAV - DOUBLE DUCT VAV

Peaked at Time ==> Mo/Hr: 7/16 Mo/Hr: 7/16 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 OADB: 97 OADB: 24 Ret. Air Ret. Air Net Percnt * Percnt * Space Peak Coil Peak Space Space Percnt Total Of Tot Sens.+Lat. Sensible Of Tot * Latent Sensible Space Sens Tot Sens Of Tot (%) * (Btuh) (Btuh) (Btuh) (Btuh) Envelope Loads (Btuh) (Btuh) (%) (Btuh) (%) Skylite Solr 0 0 0 0.00 n 0.00 * O 0.00 Skylite Cond 0 0 0.00 0 0.00 * 0 0 0.00 Roof Cond 0 11,482 11,482 3.62 0.00 * -11,284 5.36 0.00 * Glass Solar 0 0 0.00 0 0 0 0 0.00 0 0.00 * Glass Cond 0 Ω 0.00 Ω 0 0 0.00 97,399 30.53 * Wall Cond 73,720 23,679 30.69 73,720 -128,997 -166,870 79.20 Partition -24,826 -24,826 -7.82 -24,826 -10.28 * -60,134 -60,134 28.54 Exposed Floor 0 0 0.00 a 0.00 * 0 0.00 Infiltration 5,260 5,260 1.66 6.869 2.84 * -14,848 -14,848 7.05 54,154 23.09 * Sub Total ==> 35,161 89,316 28.14 55,763 -203,980 -253,137 120.15 Internal Loads 19.01 * 24.99 * Lights 60,341 0 60,341 60,341 0 0.00 8.60 27,300 27,300 6.19 * People 14,950 0 0.00 43.02 * Misc 103,877 103,877 32.73 103,877 0 0.00 Sub Total==> 191,518 0 191,518 74.20 * 0 60.34 179,168 0.00 2.70 * Ceiling Load 8,104 -8.104 0 0.00 6,525 -24,436 0.00 4.83 0.00 * Outside Air. . 0 0 15,324 0 0 0 0.00 Sup. Fan Heat 23,638 7.45 0.00 * 8,348 -3.96 Ret. Fan Heat 0 0 0.00 0.00 * 0 0.00 Duct Heat Pkup 0 0.00 0.00 * 0.00 0 OV/UNDR Sizing 0 0.00 0.00 * 0 0 0.00 Exhaust Heat -2,420 -2.420 -0.76 0.00 * 0 34,103 -16.19Terminal Bypass 0 O O -0.00 0.00 0 0.00 Grand Total==> 253,776 24,638 317,376 100.00 * 241,456 100.00 * -228,416 -210,686 -----COOLING COIL SELECTION----------AREAS-----Sens Cap. Coil Airfl Total Capacity Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) Deg F Deg F Grains (Mbh) (cfm) Deg F Deg F Grains Floor 12,065 Main Clg 13,036 317.4 26.4 311.2 78.6 59.3 56.7 53.1 49.8 56.7 Part 17,254 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 Roof 4,235 0 0 Totals 26.4 317.4 Wall 8,132 0 0 ------HEATING COIL SELECTION---------- AIRFLOWS (cfm)------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Lvg Type Cooling Heating Clg % OA 7.0 Clg Type Htg (Mbh) (cfm) Deg F Deg F Vent 907 0 Clg Cfm/Sqft 1.07 55.0 125.0 -340.6 Main Htg 4,603 47.7 125.0 Infil 323 323 Clg Cfm/Ton 489.98 Plenum 77.2 64.2 Aux Htg 0.0 0 0.0 0.0 Supply 12,959 4,501 Clg Sqft/Ton 456.19 77.2 Return 64.3 Preheat -25.3 907 24.0 53.1 Mincfm 0 0 Clg Btuh/Sqft 26.31 Ret/OA 78.6 24.0 Reheat -0.0 0 0.0 0.0 Return 13,036 4,603 No. People 65 Runarnd 74.5 72.0 **Humidif** 0.0 0 0.0 0.0 Exhaust 907 4,603 Htg % OA 0.0 Fn MtrTD 0.6 0.0

0

0

0

Htg Cfm/SqFt

Htg Btuh/SqFt -30.32

0.37

Fn BldTD

Fn Frict

0.5

1.4

0.0

0.0

VAVOO

- DOUBLE DUCT VAV System 2 Block Mo/Hr: 7/16 Mo/Hr: 13/ 1 Mo/Hr: 7/16 Peaked at Time ==> OADB: 97 OADB: 24 OADB/WB/HR: 97/ 64/ 49.0 Outside Air ==> Percnt * Space Peak Coil Peak Percnt Net Percnt * Space Space Ret. Air Ret. Air Of Tot * Of Tot Space Sens Tot Sens Total Of Tot * Sensible Sens.+Lat. Sensible Latent (%) * (Btuh) (%) (Btuh) (Btuh) (Btuh) (%) (Btuh) (Btuh) Envelope Loads (Btuh) 0 0 0.00 0.00 0 0.00 * 0 Ω Skylite Solr 0 0 0.00 * 0 0 0.00 0.00 n 0 0 Skylite Cond 0.00 * 0 -11,282 5.40 2.28 Ω 11,727 0 11,727 Roof Cond 0.00 * 0 0 0.00 0.00 n 0 Glass Solar Ω 0.00 * 0.00 0 0 0 0.00 0 0 Glass Cond 0 16.46 * 77.22 16.96 65,647 -124,832 -161,268 87,313 65,647 21,666 Wall Cond -27,053 -6.78 * -5.25 -64,928 -64,928 31.09 -27,053 -27,053 Partition 0.00 * 0 0.00 0.00 0 Exposed Floor G -14,848 7.11 6,869 1.72 * -14,848 6,209 1.21 Infiltration 6,209 15.19 11.40 * -204,608 -252,326 120.82 45,463 78,196 33,393 Sub Total==> 44,802 Internal Loads 0.00 18.43 * 0 0 14.28 73,523 73,523 Lights 73,523 0 0.00 2.71 * n n 19,740 3.83 10,810 People 19,740 0.00 266,323 66.77 * 0 266,323 51.73 0 Misc 266,323 0.00 87.91 * 0 350,655 359,585 69.84 359,585 0 0 Sub Total ==> 0.69 * -23,857 0.00 2,755 4,807 0.00 -4,807 Ceiling Load 0.00 0.00 * 0 30,394 5.90 O 0 0 Outside Air 10,552 -5.05 0.00 * 49,684 9.65 Sup. Fan Heat 0.00 0.00 * 0 0 0.00 Ret. Fan Heat O 0.00 O 0.00 0.00 0 Duct Heat Pkup Λ 0 0.00 0.00 0.00 n OV/UNDR Sizing -15.76 0.00 32,924 -0.59 -3,016 -3,016 Exhaust Heat 0.00 0.00 -0.00 Terminal Bypass -208,850 100.00 514,843 100.00 * 100.00 * -228,465 398,874 Grand Total ==> 409,195 25,570 ------AREAS----------COOLING COIL SELECTION-----**Gross Total** Glass (sf) (%) Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Deg F Deg F Grains 12,065 Floor Deg F Deg F Grains (Tons) (Mbh) (Mbh) (cfm) Part 15,624 52.2 52.6 48.6 52.6 58.0 514.8 509.7 21,664 77.9 Main Clg 42.9 0.0 Exflr 0 0.0 0.0 0.0 0 0.0 Aux Clg 0.0 0.0 0.0 0.0 0.0 0.0 Roof 4,235 0.0 0.0 0.0 0.0 Opt Vent 0.0 0.0 0.0 7,884 Wall 42.9 514.8 Totals -----AIRFLOWS (cfm)------- ENGINEERING CHECKS---- TEMPERATURES (F)---------HEATING COIL SELECTION-----Clg % OA 7.1 Type Type Cooling Heating Capacity Coil Airfl Ent Lvg SADB 55.0 125.0 Clg Cfm/Sqft 1.79 (cfm) Deg F Deg F Vent 1,522 0 (Mbh) 76.4 64.4 4,601 323 323 Clg Cfm/Ton 502.74 Plenum -420.2 29.6 125.0 Infil Main Htg 64.5 21,569 4,502 Clg Sqft/Ton 281.21 Return 76.4 0 0.0 በ_በ Supply Aux Htg 0.0 Ret/OA 77.9 24.0 Ω 0 Clg Btuh/Saft 42.67 -41.7 1,522 24.0 52.6 Mincfm Preheat 74.3 72.0 4,601 47 Runarnd 0.0 Return 21,664 No. People -0.0 0.0 Reheat Htg % OA Fn MtrTD 0.8 0.0 4,601 0.0 0 0.0 0.0 Exhaust 1,522 Humidif 0.0 Fn BldTD 0.6 0.0 0.37 0.0 0.0 Rm Exh 0 O Htg Cfm/SqFt 0.0 n Opt Vent 0 Htg Btuh/SqFt -38.28 Fn Frict 1.8 Auxil 0 Total -461.9

Total

-1,305.5

System 3 Block DDVAV - DOUBLE DUCT VAV

Peaked a	t Time ==:	>	Mo/Hr:	7/16			* Mo	/Hr:	7/16 *		Mo/Hr: 1	5/ 1	
Outside	Air ==>	OA	DB/WB/HR:	97/ 64/ 49.0	0		* 0	ADB:	97 *		OADB:	24	
							*		*				
		Space	Ret. Air	Ret. Air	Ne	t Percnt	* S	pace	Percnt *	Space Po	eak Coili	eak	Percni
	Se	ens.+Lat.	Sensible	Latent	Tota	l Of Tot	* Sens	ible	Of Tot *	Space Se	ens Tot	Sens	Of Tot
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh) (%)	* (B	tuh)	(%) *	(Bti	uh) (B	tuh)	(%)
Skylit	e Soir	0	()		0.00	*	0	0.00 *		0	0	0.00
Skylit	e Cond	0	()		0.00	*	0	0.00 *		0	0	0.00
Roof C	ond	0	37,742	:	37,74	2 3.38	*	0	0.00 *		0 -36	,526	7.22
Glass	Solar	14,028	()	14,02	8 1.26	* 14	,028	1.67 *		0	0	0.00
Glass	Cond	6,931	(1	6,93		* 6	,931	0.82 *	-16,9	967 -16	967	3.3
Wall C	ond	131,183	45,679	•	176,86	2 15.84		, 183	15.57 *			.375	69.05
Partit	ion	-45,200	•		-45,20			,200	-5.37 *	-			29.6
	d Floor	0				0.00		. 0	0.00 *	•	0	0	0.00
•	ration	18,514			18,51			,270	2.52 *	-45,3		,361	8.96
	tal==>	125,455	83,421		208,87			,211	15.22 *				118.20
Internal		100,400			200,0		*	,	*	7.57		,	
Lights		238,645	(1	238,64	5 21.37	* 238	,645	28.33 *		0	0	0.00
People		64,680		•	64,68			,420	4.20 *		0	Ŏ	0.00
Misc	21	425,318	(0	425,31			,318	50.49 *	3 :		,208	-0.63
	tal==>	728,643	ì		728,64			,382	83.02 *			,208	
Ceiling		15,288	-15,288	•	-			,302 ,811	1.76 *	•		,208	-0.63
Outside		0	15,200				• •	,011		-01,	0	0	0.00
Sup. Fan		·	•		61,24			U	0.00 *		_		0.00
Ret. Fan			(•	123,04		•		0.00 *		27	, 139	-5.76
Duct Hea			(•					0	0.00
	•	0	,	•		0.00		•			^	0	0.00
OV/UNDR	_	0	- 5 055			0.00		0	0.00 *		0	0	0.00
Exhaust Tooming!			-5,055 (-5,05				0.00 *		29	,751	-11.8
Terminal	вураза		,	, ,		0 -0.00			0.00 *			0	0.00
Grand To	tal==>	869,386	63,078	0	1,116,75	1 100.00	* 842	,405	100.00 *	-542,7	798 -506	,002	100.00
	Total	Capacity		LING COIL SI Coil Airfl		ing DB/WB/			B/WB/HR	Gross Tot	AREAS-) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)		eg F Grai		-				35 (51	, (~)
ain Clg	93.1				-	-	_	_	Grains	Floor	36,710		
_		1,116.8	1,099.2	45,238		58.2 53		48.4		Part	41,631		
ux Clg	0.0	0.0	0.0	0	0.0		.0 0.0	0.0		ExFlr	0		
pt Vent	0.0	0.0	0.0	0	0.0	0.0 0	.0 0.0	0.0	0.0	Roof	13,521	_	0 (
otals	93. 1	1,116.8								Wall	17,879	5	01 3
	HEATING	COIL SEL	ECTION		A	IRFLOWS (c	fm)	•	ENGINEERING	CHECKS	TEMPER	ATURES	(F)
	Capacity			Lvg	Type	Cooling	Heating	Cl	g % OA	7.1	Type	Clg	Ktg
	(Mbh)	(cfi	_	_	Vent	3,209	0		g Cfm/Sqft	1.23	SADB	55.0	125.0
ain Htg	-1,219.0	-			Infil	987	987	Ct	g Cfm/Ton	486.00	Plenum	76.1	66.2
ux Htg	0.0		0 0.0	0.0	Supply	45,229	10,696	Ct	g Sqft/Ton	394.47	Return	76.1	66.2
reheat	-86.5	-	209 24.0	52.2	Mincfm	0	0	Cl	g Btuh/Sqft	30.42	Ret/OA	77.6	24.0
eheat	-0.0		0 0.0	0.0	Return	45,238	10,713	No	. People	154	Runarnd	74.5	72.0
umidif	0.0)	0 0.0	0.0	Exhaust	3,209	10,713	Ht	g % OA	0.0	Fn MtrTD	0.9	0.0
pt Vent	0.0)	0 0.0	0.0	Rm Exh	0	_e o	Ht	g Cfm/SqFt	0.29	Fn BldTD	0.7	0.0
otal	_1 705 5	•	,		Acres 1	^	<u>_</u>	•••	- 04.4 10-5.	75 54	e ·		

Auxil

Htg Btuh/SqFt -35.56 Fn Frict 2.1

0.0

BUILDING U-VALUES - ALTERNATIVE 1 ECO - VAV ON AHUS - BUILDING 300

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------ BUILDING U-VALUES-----

					Pag	m II-Val	I 166				Room	Room
						/hr/sqf		•			Mass	Capac.
g.com				Summr	Wintr	, iii , 54i	Summr	Wintr			(lb/	(Btu/
Room	Description	Dont	ExFlr	Skylt	Skylt	Poof	Windo	Windo	Ual I	Ceil.	sqft)	sqft/F)
Number	Description	Part.	EXPLI	SKYLL	SKYLL	KOOI	#1120	#1120	watt	00.11.	54.17	04.1,1,
1	Z1-BSMT EAST	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
Zone	1 Total/Ave.	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
2	Z1-1ST FLR EAST	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
Zone	2 Total/Ave.	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
3	Z2-1ST FLR EAST	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
Zone	3 Total/Ave.	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
4	Z1-2ND FLR EAST	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
Zone	4 Total/Ave.	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
5	Z2-2ND FLR EAST	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
Zone	5 Total/Ave.	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
System	1 Total/Ave.	0.393	0.000	0.000	0.000	0.070	0.000	0.000	0.448	0.317	148.3	29.43
6	Z1-BSHT WEST	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
Zone	6 Total/Ave.	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
7	Z2-BSMT WEST	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
Zone	7 Total/Ave.	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	40 79.	96
8	Z1-1ST FLR WEST	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
Zone	8 Total/Ave.	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
9	Z2-1ST FLR WEST	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
Zone	9 Total/Ave.	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
10	Z1-2ND FLR WEST	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
Zone	10 Total/Ave.	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
11	Z2-2ND FLR WEST	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
Zone	11 Total/Ave.	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
System	2 Total/Ave.	0.472	0.000	0.000	0.000	0.070	0.000	0.000	0.446	0.317	152.2	30.37
12	Z3-BSMT SOUTH	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
Zone	12 Total/Ave.	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
13	Z2-BSMT SOUTH	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
Zone	13 Total/Ave.	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
14	Z1-BSMT SOUTH	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
Zone	14 Total/Ave.	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
15	Z1-1ST FLR SOUTH	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
Zone	15 Total/Ave.	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
16	Z2-1ST FLR SOUTH	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
Zone	16 Total/Ave.	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
17	Z3-1ST FLR SOUTH	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
Zone	17 Total/Ave.	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
18	Z3-2ND FLR SOUTH	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
Zone	18 Total/Ave.	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
19	Z1-2ND FLR SOUTH	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
Zone	19 Total/Ave.	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
20	Z2-2ND FLR SOUTH	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
Zone	20 Total/Ave.	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
System	3 Total/Ave.	0.417	0.000	0.000	0.000	0.070	0.653	0.706	0.437	0.317	129.1	25.81
Buildir	ng	0.423	0.000	0.000	0.000	0.070	0.653	0.706	0.442	0.317	137.5	27.43

BUILDING AREAS - ALTERNATIVE 1 ECO - VAV ON AHUS - BUILDING 300

BUILDING AREAS -----

				Floor	Total		Exposed						
				Area/Dupl	Floor	Partition	Floor	Skylight	Skl	Net Roof	Window	Win	Net Wall
Room		•	icate	Room	Area	Area	Area	Area	/Rf	Area	Area	/WL	Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	ZMT EAST 1	1		3,595	3,595	8,458	0	0 0		0	0 0		247
Zone	1 Total/Ave.				3,595	8,458	0	0	0	0	0	0	247
2	Z1-1ST FLR EAST	1	1	1,595	1,595	2,145	0	0	0	0	0	0	1,368
Zone	2 Total/Ave.			•	1,595	2,145	0	0	0	0	0	0	1,368
3	Z2-1ST FLR EAST	1	1	2,640	2,640	858	0	0	0	o	0	0	2,574
Zone	3 Total/Ave.			•	2,640	858	0	0	0	o	0	0	2,574
4	21-2ND FLR EAST	1	1	1,595	1,595	3,045	0	0	0	1,595	0	0	1,368
Zone	4 Total/Ave.			•	1,595	3,045	0	0	0	1,595	0	0	1,368
5	Z2-2ND FLR EAST	1	1	2,640	2,640	2,748	0	0	0	2,640	0	Ō	2,574
Zone	5 Total/Ave.				2,640	2,748	0	0	0	2,640	0	0	2,574
System	1 Total/Ave.				12,065	17,254	0	0	0	4,235	0	0	8,132
6	Z1-BSMT WEST	1	1	3,280	3,280	5,763	0	0	0	. 0	0	0	0
Zone	6 Total/Ave.				3,280	5,763	0	0	0	0	0	Ō	0
7	Z2-BSMT WEST	1	1	315	315	909	0	0	0	0	0	0	0
Zone	7 Total/Ave.				315	909	0	0	0	0	0	0	0
8	Z1-1ST FLR WEST	1	1	1,595	1,595	2,784	0	0	0	0	0	0	1,368
Zone	8 Total/Ave.				1,595	2,784	0	0	0	0	0	0	1,368
9	Z2-1ST FLR WEST	1	1	2,640	2,640	1,080	0	0	0	0	0	0	2,574
Zone	9 Total/Ave.				2,640	1,080	0	0	0	0	0	0	2,574
10	Z1-2ND FLR WEST	1	1	1,595	1,595	2,565	0	0	0	1,595	0	0	1,368
Zone	10 Total/Ave.				1,595	2,565	0	0	0	1,595	0	0	1,368
11	Z2-2ND FLR WEST	1	1	2,640	2,640	2,523	0	0	0	2,640	0	0	2,574
Zone	11 Total/Ave.				2,640	2,523	0	0	0	2,640	0	0	2,574
System	2 Total/Ave.				12,065	15,624	0	0	0	4,235	0	0	7,884
	Z3-BSMT SOUTH	1	∻ 1	2,202	2,202	6,539	0	0	0	0	0	0	0
Zone	12 Total/Ave.				2,202	6,539	0	0	0	0	0	0	0
	Z2-BSMT SOUTH	1	1	3,780	3,780	9,473	0	0	0	0	0	0	0
Zone	13 Total/Ave.				3,780	9,473	0	0	0	0	0	0	0
	Z1-BSMT SOUTH	1	1	3,685	3,685	8,091	0	0	0	0	0	0	49
Zone	14 Total/Ave.				3,685	8,091	0	0	0	0	0	0	49
_	Z1-1ST FLR SOUTH	1	1	4,089	4,089	6,168	0	0 0)	0	0 0)	2,628
Zone	15 Total/Ave.		_		4,089	6,168	0	0	0	Ô	0	0	2,628
	Z2-1ST FLR SOUTH	1	1	6,002	6,002	2,415	0	0	0	0	501	14	3,171
Zone	16 Total/Ave.				6,002	2,415	0	0	0	0	501	14	3,171
	23-1ST FLR SOUTH	1	1	3,430	3,430	2,352	0	0	0	0	0	0	2,475
Zone	17 Total/Ave.				3,430	2,352	0	0	0	0	0	0	2,475
	Z3-2ND FLR SOUTH	1	1	5,763	5,763	3,444	0	0	0	5,763	0	0	3,348
Zone	18 Total/Ave.	_			5,763	3,444	0	0	0	5,763	0	0	3,348
	Z1-2ND FLR SOUTH	1	1	2,077	2,077	930	0	0	0	2,077	0	0	2,313
Zone	19 Total/Ave.			.	2,077	930	0	0	0	2,077	0	0	2,313
	22-2ND FLR SOUTH	1	1	5,681	5,681	2,220	0	0	0	5,681	0	0	3,393
Zone	20 Total/Ave.				5,681	2,220	0	0	0	5,681	0	0	3,393
System	3 Total/Ave.				36,710	41,631	0	0	0	13,521	501	3	17,378
Building	j				60,840	74,509	0	0	0	21,991	501	1	33,393

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1 ECO - VAV ON AHUS - BUILDING 300

System Totals

and the second

Percent	Cool	ing Loa	d	Heatir	ng Load		Cooling	Airflow		Heating		
Design	Cap.	_	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	8.1	7	628	-106,665	35	1,740	3,987.9	0	0	0.0	0	0
5 - 10	16.2	8	704	-213,330	27	1,340	7,975.7	0	0	0.0	0	0
10 - 15	24.4	9	826	-319,995	16	785	11,963.6	0	0	0.0	0	0
15 - 20	32.5	10	870	-426,660	9	447	15,951.5	0	0	0.0	0	0
20 - 25	40.6	7	636	-533,325	6	305	19,939.3	0	0	0.0	0	0
25 - 30	48.7	9	796	-639,990	4	189	23,927.2	3	258	0.0	0	0
30 - 35	56.8	7	597	-746,655	2	120	27,915.0	16	1,376	0.0	0	0
35 - 40	65.0	6	514	-853,320	1	41	31,902.9	17	1,512	0.0	0	0
40 - 45	73.1	7	655	-959,985	0	0	35,890.8	16	1,375	0.0	0	0
45 - 50	81.2	5	434	-1,066,650	0	0	39,878.6	13	1,140	0.0	0	0
50 - 55	89.3	4	373	-1,173,315	0	0	43,866.5	12	1,086	0.0	0	0
55 - 60	97.4	4	351	-1,279,980	0	0	47,854.4	8	692	0.0	0	0
60 - 65	105.6	4	379	-1,386,645	0	0	51,842.2	2	217	0.0	0	0
65 - 70	113.7	2		-1,493,311	0	0	55,830.1	3	236	0.0	0	0
70 - 75	121.8	2		-1,599,975	0	0	59,818.0	3	227	0.0	0	0
75 - 80	129.9	1		-1,706,641	0	0	63,805.8	2	189	0.0	0	0
80 - 85	138.1	2		-1,813,305	0	0	67,793.7	2	193	0.0	0	0
85 - 90	146.2	1		-1,919,971	0	0	71,781.5	1	131	0.0	0	0
90 - 95	154.3	;	123	-2,026,636	0	0	75,769.4	1	85	0.0	0	0
90 - 95	162.4	2		-2,133,301	0	0	79,757.3	0	43	0.0	0	0
Hours Off	0.0	0		0	0	3,793	0.0	0	0	0.0	0	8,760

70N-HS 644,400

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

MONTHLY	ENERGY	CONSUMPTION

	ELEC	DEMAND	GAS		GAS DMND	
	On Peak	On Peak	On Peak	WATER	On Peak	
Month	(kWh)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)	
Jan	244,173	553	4,414	51	12	
Feb	224,503	558	3,512	. 52	11	
March	268,288	598	1,615	99	6	
April	275,932	653	471	137	3	
May	318,064	688	96	205	2	
June	326,038	722	0	250	0	
July	345,612	736	0	304	0	
Aug	349,221	731	0	300	0	
Sept	317,545	700	34	230	1	
Oct	295,923	649	544	152	2	
Nov	255,015	594	1,785	92	6	
Dec	251,938	564	3,379	66	8	
Total	3,472,254	736	15,849	1,938	12	
Building Ene	ergy Consumption =	220,8	36 (Btu/Sq	Ft/Year)	Flo	oor Area =

Source Energy Consumption = 221,641 (Btu/Sq Ft/Year)

Floor Area = 60,840 (Sq Ft)

= monthly 1cm = 8492 7,746

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-----UTILITY PEAK CHECKSUMS-----

Utility ELECTRIC DEMAND

Peak Value 735.8 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

personal personal

Eap.			Utility	Percnt
Ref.	Equipment		Demand	Of Tot
Num.	Code Name	Equipment Description	(kW)	(%)
Cooling Ed	quipment			
1	EQ1001S	2-STG CTV <555 TONS	195.9	26.62
Sub Total			195.9	26.62
Sub Total			0.0	0.00
Air Moving	g Equipment			
1		SUMMATION OF FAN ELECTRICAL DEMAND	46.3	6.29
2		SUMMATION OF FAN ELECTRICAL DEMAND	33.3	4.52
3		SUMMATION OF FAN ELECTRICAL DEMAND	115.0	15.63
Sub Total			194.6	26.45
Sub Total			0.0	0.00
Miscelland	eous			
Lights			109.1	14.83
Base Uti	lities		0.0	0.00
Misc Equ	ipment		236.2	32.10
Sub Total	•		345.3	46.93
Grand Tot	al		735.8	100.00

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION: Whit	te Sands Missile F	Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	BLDG. 300 - CC	ONSOLIDATED CHILL	ER PLANT		FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME: T	OTAL				
		ANALYSIS DATE:	06/10/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
	1813	/EOTMENIT						
		/ESTMENT						
		CONSTRUCTION	COSI	(E E0) -(4 A)			\$56,100	
		SIOH COST DESIGN COST		(5.5% of 1A) =			\$3,086	
	-	ENERGY CREDIT		(6.0% of 1A) =			\$3,366	
				(1A + 1B + 1C) =			\$62,552	
	•	TOTAL INVESTME	INIT	(4D 4E) =			\$0	400 554
	١.	TOTAL INVESTIGE	2141	(1D – 1E) =			>	\$62,552
2	ΕN	ERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	635	\$4,112	15.23	\$62,621	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	0	\$0	19.64	\$0	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		635	4,111.7		>	\$62,621
3	NO	N-ENERGY SAVIN	GS (+) / COST (-)					
	A.	ANNUAL RECURP	RING (+/-) (ELEC.	DEMAND SAVINGS +	-		\$8,009	
		MAINTENANCE CO	OST SAVINGS)					
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	SAVINGS (+) / COS	ST (-)	(3A x 3A1) =		\$117,572	
	В.	NON-RECURRING	G (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		C.		\$0		0.00	\$0	
	_	d TOTAL		\$0			\$0	
				ED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$117,572
	D.	PROJECT NON-E						
		1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$20,665	
		a IF 3D1 => 3C T						
			HEN CALCULATE	SIR		(2F5 + 3D1) / 1F =	1.33	
		c IF 3D1b => 1 T						
		d IF 3D1b < 1 Th	HEN PROJECT DO	DES NOT QUALIFY				
		OT VEAD DOLL :=	041/IN/00/11/15					
		ST YEAR DOLLAR		OSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$12,121
		TAL NET DISCOUN				(2F5 + 3C) =		\$180,193
6		SCOUNTED SAVING				(5/1F) =		2.88
-		F SIR < 1 THEN PRO		I QUALIFY)				
′	31 ₹	IPLE PAYBACK (SP	·D)			(1F/4) ≃		5.16

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BEAKDO	N.							
				ADDRESS			000 7#	DENVER CC	80227	
CONTRACTOR	EMC ENGINEERS INC.			2750 SOU	TH WADSW	JAIH BLVL	ROPOSED TOTAL	2750 SOUTH WADSWORTH BLVD., #C-200, DEINTERNOT PRICE		
CONTRACT FO	CONTRACT FOR (Work to be performed)	8					NOTA OCCUPANT			
PURCHASE PE	CONSOLIDA I ED CHILLEN TENN ELECTORINA E RECUEST NUMBER			PROJECT NUMBER	E		WHITE SAN	DS MISSILE	WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	cost		LABOR COSTS		Other	
g	Item	Cnit	Quantity	\$0.00 1	Total	Manhours Mandays	Average Rate	Total	Direct Costs	Line Total
o S	(1)	(2)	69	4	(5)	(9)	6	(6)		
	CONSOLIDATED CHILLER PLANT							o de co	A & Profit	\$51,000
	100 TON WIR CLD RECIP. CHILLER	EA	-	51000	21000	Cost includes	Material & La	Cost includes Material & Labor w Overnoo		es 100
	(%01) ASNAUNLINGS									
D13	Source: Means Mechanical Cost Data, 1992									
			_							
			_	-						
				1						
			_						-	
						-				8, 634
	TOTAL THIS SHEET								-	00°, 100°

ESOS STUDY AT WSMR - BUILDING 300
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
RANGE CONTROL BLDG: ALT 1-BSLN, ALTZ-ECO CONSOlidated Chilled Water Plant

Weather File Code:	ELPASO).W
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	

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Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/f)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 18: 5:50 3/13/92
Dataset Name: 300 .TM

Block

DĐ

- DOUBLE DUCT

System

Peaked at Time ==> Mo/Hr: 7/16 Mo/Hr: 7/16 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 OADB: 97 OADB: 24 Space Ret. Air Ret. Air Net Percnt Space Percnt * Space Peak Coil Peak Percnt Sens.+Lat. Sensible Latent Total Of Tot Sens i ble Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) (Btuh) (Btuh) (2) Skylite Solr 0 0 0 0.00 0.00 0 0.00 0 Skylite Cond 0 0 0 0.00 O 0.00 0 O 0.00 Roof Cond 0 12,734 12,734 2.70 0 0.00 O -13,550 3.56 Glass Solar 0 0 O 0.00 n 0.00 0 0 0.00 Glass Cond 0 0 0 0.00 0 0.00 0 0.00 Wall Cond 81,136 27,781 108,917 23.06 81,117 28.85 -128,969 -173,237 45.46 Partition -4,965 -4,965 -1.05 -4,965 -1.77 -60,134 -60,134 15.78 Exposed Floor 0 0 0.00 0 0.00 0.00 Infiltration 6,185 1.31 6,185 7,886 2.80 -14,848 -14,848 3.90 Sub Total ==> 82,355 40,515 122,871 26.01 84,038 29.88 -203,952 -261,770 68.69 Internal Loads Lights 60,341 0 60,341 12.77 60,341 21,46 0 0.00 People 27,300 27,300 5.78 14,950 5.32 0 0.00 Misc 103,877 0 0 103,877 21.99 103,877 36.94 0 0.00 Sub Total ==> 191,518 0 191,518 40.54 179,168 63.71 0 0 0.00 Ceiling Load 3,991 -3.991 0 0.00 3,230 1.15 -4,628 0 0.00 Outside Air 0 62,240 13.18 0.00 0 -149,417 39.21 Sup. Fan Heat 84,211 17.83 0.00 84,211 -22.10 Ret. Fan Heat O 0 0.00 0.00 0 0.00 **Duct Heat Pkup** 0 0 0.00 0.00 0 0.00 OV/UNDR Sizing 14,770 14,770 3.13 14,770 5.25 -58,220 -58,220 15.28 Exhaust Heat -3,250 0 -3,250 -0.69 0.00 4,116 -1.08 Terminal Bypass 0 0 -0.00 0.00 0.00 Grand Total ==> 292,634 33,274 472,359 100.00 * 281,206 100.00 -266,799 -381,080 100.00 -----COOLING COIL SELECTION-----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR **Gross Total** Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 12,065 Main Clg 39.4 472.4 478.2 46,440 74.7 58.0 56.8 63.8 54.1 57.3 Part 17,254 Aux Clg 0.00.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 ExFlr 0 Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 4,235 0 0 Totals 39.4 472.4 Wall 8,132 ------HEATING COIL SELECTION-----------AIRFLOWS (cfm)------- ENGINEERING CHECKS ----TEMPERATURES (F)---Capacity Coil Airfl Ent Lvg Type Cooling Heating Clg % OA 7.0 Type Clg Htg (Mbh) (cfm) Deg F Deg F Vent 3,251 3,251 Clg Cfm/Sqft 3.85 SADB 65.7 78.0 Main Htg -340.6 46,440 70.3 78.0 Infil 323 323 Clg Cfm/Ton 1179.78 Plenum 73.0 70.5 0.0 Aux Htg 0 0.0 0.0 Supply 46,440 46,440 Cig Sqft/Ton 306.51 Return 73.0 70.7 Preheat -0.0 46,440 67.4 63.8 Mincfm 0 Clg Btuh/Sqft 39.15 Ret/OA 74.7 67.4 Reheat 0.0 0 0.0 0.0 46,440 46,440 Return No. People 65 Runarnd 72.0 72.0 Humidif 0.0 0 0.0 3,251 0.0 **Exhaust** 3,251 Htg % OA 7.0 Fn MtrTD 0.6 0.0 Opt Vent 0.0 0 0.0 0.0 Rm Exh 0 0 Htg Cfm/SqFt 3.85 Fn BldTD 0.5 0.0 Total -340.6 **Auxil** 0 0 Htg Btuh/SqFt -28.23 Fn Frict 1.4 0.0

266 474 474 <u>474</u>

System 2 Block DD - DOUBLE DUCT Peaked at Time ==> Mo/Hr: 7/16 Mo/Hr: 7/16 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 OADB: 97 OADB: 24 Space Ret. Air Ret. Air Net Percnt Space Percnt * Space Peak Coil Peak Percnt Sens.+Lat. Sensible Latent Total Of Tot Sensible Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr 0 0 0 0.00 n 0.00 * 0 0 0.00 Skylite Cond 0 0 0 0.00 0 0.00 * 0 0 0.00 Roof Cond 0 12,709 12,709 2.03 0.00 0 -13,608 4.14 Glass Solar 0 0 0 0.00 0.00 0 0 0.00 Glass Cond O Λ 0.00 0 0.00 0 0 0.00 Wall Cond 72,716 24,577 97,293 15.58 72,716 16.75 -124,832 -167,314 50.84 Partition -5,411 -5,411 -0.87 -5,411 -1.25 -64,928 -64,928 19.73 Exposed Floor 0 0.00 O 0.00 0 0.00 Infiltration 7,121 7,121 1.14 7,885 1.82 -14,848 -14,848 4.51 Sub Total ==> 74,427 37,286 111,713 17.89 75,191 17.32 -204,608 -260,698 79.22 Internal Loads Lights 73,523 0 73,523 11.77 73,523 16.93 0 0.00 People 19,740 19,740 3.16 10,810 2.49 0 0 0.00 Misc 266,323 0 0 266,323 42.64 266,323 61.34 0 0 0.00 Sub Total ==> 359,585 0 n 359,585 57.57 * 350,655 80.76 0 0.00 Ceiling Load 4,319 -4,319 0 0.00 3,459 0.80 * -5,209 0 0.00 Outside Air U 0 0 60,882 9.75 0.00 -126,942 38.58 Sup. Fan Heat 90,495 14.49 0.00 90,495 -27.50 Ret. Fan Heat Ω 0.00 0.00 0 0.00 Duct Heat Pkup 0 0.00 * 0.00 0.00 OV/UNDR Sizing 4,876 4,876 0.78 4,876 1.12 * -35,774 -35,774 10.87 Exhaust Heat -2.988 O -2,988 -0.48 0.00 3,851 -1.17 Terminal Bypass 0 0 0 -0.00 0.00 0.00 Grand Total ==> 443,207 29,979 624,563 100.00 * 434,181 100.00 -245,591 -329,069 100.00 ------COOLING COIL SELECTION-----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 12,065 52.0 624.6 622.4 39,460 74.8 57.0 52.4 58.1 50.8 52.5 Part 15,624 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Exflr 0 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 4,235 52.0 624.6 Wall 7,884

Main Clg Aux Clg Opt Vent Totals ------HEATING COIL SELECTION----------AIRFLOWS (cfm)------ -- -- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Lvg Type Cooling **Heating** Clg % OA 7.0 Туре Clg Htg (Mbh) (cfm) Deg F Deg F Vent 2,762 2,762 Clg Cfm/Sqft 3.27 SADB 60.5 78.5 Main Ktg -420.2 39,460 67.4 78.5 Infil 323 323 Clg Cfm/Ton 758.16 Plenum 73.1 70.4 Aux Htg 0.0 0 0.0 0.0 Supply 39,460 39,460 Clg Sqft/Ton 231.81 Return 73.1 70.5 Preheat -0.0 39,460 67.3 58.1 Mincfm 0 0 Clg Btuh/Sqft 51.77 Ret/OA 74.8 67.3 Reheat 0.0 0 0.0 0.0 39,460 Return 39,460 No. People 47 Runarnd 72.0 72.0 **Humidif** 0.0 0 0.0 0.0 **Exhaust** 2,762 2,762 Htg % OA 7.0 Fn MtrTD 0.8 0.0 Opt Vent 0.0 0.0 0.0 Rm Exh 0 0 Htg Cfm/SqFt 3.27 Fn BldTD 0.6 0.0 Total -420.2 Auxil 0 0

Htg Btuh/SqFt

-34.83

Fn Frict

1.8

0.0

Block

DD

- DOUBLE DUCT

3

System

*****	******	*****	COOLING COI	DFAK ****	*****	*****	****	**** (16	SPACE	F DEAK ****	*****	HEATING (OII DEAF	******
	at Time =		Mo/Hr:				*		/Hr:		*		Ir: 13/ 1	
	Air ==>		ADB/WB/HR:	•	n		*		ADB:		*		B: 24	
outorac		·	noo, no, inc.	71, 04, 47	••		*	Ŭ	ADD.	· ·	*	-		
		Space	Ret. Air	r Ret. Air	Ne	t Percnt	*	s	pace	Percnt	* Space	Peak C	oil Peak	Percnt
		Sens.+Lat.						Sens	•	Of Tot	•		Tot Sens	Of Tot.
Envelop		(Btuh)			(Btuh				tuh)		•	Stuh)	(Btuh)	(%)
	te Solr	0			-	0.00		•-	0	0.00		0	0	0.00
•	te Cond	0	C)		0.00			0	0.00		0	0	0.00
Roof (0			41,02				0	0.00		0	-43,963	5.50
Glass	Solar	14,028			14,02			40	,581	4.51		0	0	0.00
Glass		8,239	C)	8,23				,819	0.65		,967	-16,967	2.12
Wall (147,401	52,964		200,36				487	15.06		·	-3 61,665	45.23
Parti		-12,991	,		-12,99				991	-1.44			-149,871	18.74
	ed Floor	0			-	0.00			0	0.00		0	0	0.00
•	tration	20,007			20,007			23	, 124	2.57		,361	-45,361	5.67
	otal==>	176,683	93,986		270,670				,019	21.34			-617,828	77.27
Internal		110,003	73,700	•	210,010	, 17.40	*	172	,017	21.54	+	,,,,	-017,020	11.21
Lights		238,645	0		238,645	5 15.41	*	238,	645	26.52		0	0	0.00
People		64,680	•		64,680				,420	3.94		0	0	0.00
Misc	•	425,318	0	0	425,318			425		47.27		,208	3,208	-0.40
	otal==>	728,643	0		728,643			699		77.72		,208	3,208	-0.40
Ceiling		7,657	-7,657	_	(120,043				258	0.81		,689	0,200	0.00
Outside		0	0		189,859			• •	0	0.00			-430,464	53.84
Sup. Fan		•	·	•	363,958				٠	0.00		•	363,958	-45.52
Ret. Fan			0	20 T	000,,,,					0.00			0	0.00
Duct Kea			0		Č					0.00			Ô	0.00
OV/UNDR	•	1,182	•		1,182			1.	182	0.13		.578	127,578	15.96
Exhaust	-	.,	-5,903	0	-5,903			• •		0.00		,,,,	9,137	-1.14
Terminal			0	0	0					0.00			0	0.00
	-7,			_	·		*			•	•		•	0.00
Grand To	tal==>	914,165	80,427	0	1,548,408	100.00	*	899,	842	100.00	-614	,985 -	799,567	100.00
			000	LING COIL S	E! ECT ! (N)							ARE	.40	
	Total	Capacity	Sens Cap.	Coil Airfl		ng DB/WB/	'HR	Leav	ing Di	B/WB/HR	Gross To		Glass (si	f) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)		g F Grai			_	Grains	Floor	36,710		
Main Clg	129.0	1,548.4	1,560.1	133,808			.1	62.1	53.0	55.3	Part	41,631		
Aux Clg	0.0	0.0	0.0	. 0			.0	0.0	0.0	0.0	Exflr	0		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0 0	.0	0.0	0.0	0.0	Roof	13,521		0 0
Totals	129.0	1,548.4									Wall	17,879	5	01 3
•••••	HEATIN	G COIL SELE	ECTION		AI	RELOUS (C	fm)-		F	ENGINEERING	CHECKS:	TEN	PERATURES	(E)
	Capacit			Lvg	Туре	Cooling		eating		% OA	7.0	Тур		Htg
	(Mbh)			Deg F	Vent	9,366	•••	9,366		Cfm/Sqft	3.64	SADB	65.0	-
Main Htg	-1,219.		-	76.8	Infil	987		987		Cfm/Ton	1037.00	Plenu		
Aux Htg	0.0		0.0	0.0	Supply	133,808		133,808		Sqft/Ton	284.50	Retur		
Preheat	-0.6			62.1	Mincfm	0		0	-	Btuh/Sqft		Ret/0		
Reheat	0.0	-	0 0.0	0.0	Return	133,808		133,808	-	People	154	Runar		
Humidif	-439.3			75.1	Exhaust	9,366		9,366		% OA	7.0	Fn Mt		
Opt Vent	0.0	-	0.0	0.0	Rm Exh	0		0		Cfm/SqFt	3.64	Fn Bl		
Total	-1,658.3		, ,,,,		Auxil	0		0		Btuh/SqFt		Fn Fr		
									_	,				

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 300

------ BUILDING U-VALUES-----

	Room U-Values								Room	Room		
					(Bt	u/hr/sq	ft/F)				Mass	Capac.
Room	П			Summr	Wintr	•	Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	Z1-BSMT EAST	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
Zone	1 Total/Ave.	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
2	21-1ST FLR EAST	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
Zone	2 Total/Ave.	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
3	Z2-1ST FLR EAST	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
Zone	3 Total/Ave.	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
4	Z1-2ND FLR EAST	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
Zone	4 Total/Ave.	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
5	Z2-2ND FLR EAST	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
Zone	5 Total/Ave.	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
System	1 Total/Ave.	0.393	0.000	0.000	0.000	0.070	0.000	0.000	0.448	0.317	148.3	29.43
6	Z1-BSMT WEST	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
Zone	6 Total/Ave.	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
7	Z2-BSHT WEST	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
Zone	7 Total/Ave.	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	
8	Z1-1ST FLR WEST	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
Zone	8 Total/Ave.	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
9	Z2-1ST FLR WEST	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
Zone	9 Total/Ave.	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
10	Z1-2ND FLR WEST	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
Zone	10 Total/Ave.	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
11	Z2-2ND FLR WEST	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
Zone	11 Total/Ave.	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
System	2 Total/Ave.	0.472	0.000	0.000	0.000	0.070	0.000	0.000	0.446	0.317	152.2	30.37
12	Z3-BSMT SOUTH	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
Zone	12 Total/Ave.	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
13	Z2-BSMT SOUTH	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
Zone	13 Total/Ave.	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
14	Z1-BSMT SOUTH	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
Zone	14 Total/Ave.	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
15	Z1-1ST FLR SOUTH	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
Zone	15 Total/Ave.	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
16	Z2-1ST FLR SOUTH	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
Zone	16 Total/Ave.	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
17	Z3-1ST FLR SOUTH	0.130	0.000	0.000	0.000	0.000	0.000		0.438	0.317	61.0	11.82
Zone	17 Total/Ave.	0.130	0.000	0.000	0.000		0.000		0.438	0.317	61.0	11.82
18		0.187			0.000		0.000	0.000	0.438	0.317	112.1	23.09
Zone	18 Total/Ave.	0.187	0.000		0.000		0.000		0.438	0.317	112.1	23.09
19	Z1-2ND FLR SOUTH	0.237	0.000		0.000		0.000	0.000	0.438	0.317	141.0	28.94
Zone	19 Total/Ave.	0.237	0.000		0.000		0.000	0.000	0.438	0.317	141.0	28.94
20	Z2-2ND FLR SOUTH	0.151	0.000		0.000		0.000	0.000	0.438	0.317		
Zone	20 Total/Ave.	0.151	0.000				0.000		0.438	0.317	107.3 107.3	22.16 22.16
System	3 Total/Ave.	0.417							0.437	0.317		
Building						0.070				0.317	129.1	25.81
	-		3.000	2.000	2.000	0.070	0.000	0.700	U.442	0.517	137.5	27.43

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BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 300

------ BUILDING AREAS ------

				Floor	Total		Exposed						
		Numbe	er of	Area/Dupl	Floor	Partition	Floor	Skylight	Skl	Net Roof	Window	Win	Net Wall
Room	1	Dupli	icate	Room	Area	Area	Area		/Rf	Area	Area	/WL	Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)		(sqft)	(sqft)	(%)	(sqft)
1	Z1-BSAST 1	1		3,595	3,595	8,458	0	0 0		0	0 0		247
Zone	1 Total/Ave.				3,595	8,458	0	0	0	0	0	0	247
2	Z1-1ST FLR EAST	1	1	1,595	1,595	2,145	0	0	0	0	0	0	1,368
Zone	2 Total/Ave.				1,595	2,145	0	0	0	0	0	0	1,368
3	Z2-1ST FLR EAST	1	1	2,640	2,640	858	0	0	0	0	0	0	2,574
Zone	3 Total/Ave.				2,640	858	0	0	0	0	0	0	2,574
4	Z1-2ND FLR EAST	1	1	1,595	1,595	3,045	0	0	0	1,595	0	0	1,368
Zone	4 Total/Ave.				1,595	3,045	0	. 0	0	1,595	0	0	1,368
5	Z2-2ND FLR EAST	1	1	2,640	2,640	2,748	0	0	0	2,640	0	0	2,574
Zone	5 Total/Ave.				2,640	2,748	0	0	0	2,640	0	0	2,574
System	1 Total/Ave.				12,065	17,254	0	0	0	4,235	0	0	8,132
6	Z1-BSMT WEST	1	1	3,280	3,280	5,763	0	0	0	0	0	0	0
Zone	6 Total/Ave.				3,280	5,763	0	0	0	0	0	0	0
. 7	Z2-BSMT WEST	1	1	315	315	909	0	0	0	0	0	0	0
Zone	7 Total/Ave.				315	909	0	0	0	0	0	0	0
. 8	Z1-1ST FLR WEST	1	1	1,595	1,595	2,784	0	0	0	0	0	0	1,368
Zone	8 Total/Ave.		_		1,595	2,784	0	0	0	0	0	0	1,368
9	Z2-1ST FLR WEST	1	1	2,640	2,640	1,080	0	0	0	0	0	0	2,574
Zone	9 Total/Ave.	_	_		2,640	1,080	0	0	0	0	0	0	2,574
10		1	1	1,595	1,595	2,565	0	0	0	1,595	0	0	1,368
Zone	10 Total/Ave.			2 (/2	1,595	2,565	0	0	0	1,595	0	0	1,368
	Z2-2ND FLR WEST	1	1	2,640	2,640	2,523	0	0	0	2,640	0	0	2,574
Zone	11 Total/Ave.				2,640	2,523	0	0	0	2,640	0	0	2,574
System	2 Total/Ave. Z3-BSMT SOUTH	4		2 202	12,065	15,624	0	0	0	4,235	0	0	7,884
Zone	12 Total/Ave.	1	1	2,202	2,202	6,539	0	0	0	0	0	0	0
	Z2-BSMT SOUTH	1	1	3,780	2,202 3,780	6,539	0	0	0	0	0	0	0
Zone	13 Total/Ave.	'	•	3,700	3,780	9,473	0	0 0	0	0	0	0	0
14		1	1	3,685	3,685	9,473 8,091	0	0	0	0	0	0	0
Zone	14 Total/Ave.	•	•	3,003	3,685	8,091	0	0	0	0	0	0	49
15	Z1-1ST FLR SOUTH	1	1	4,089	4,089	6,168	0	0	Ü	0	0 0	-	49 2,628
Zone	15 Total/Ave.				4,089	6,168	0	0	0	0	0	0	2,628
16	Z2-1ST FLR SOUTH	1	1	6,002	6,002	2,415	0	0	0	Ō	501	14	3,171
Zone	16 Total/Ave.			- • • • • •	6,002	2,415	0	0	0	0	501	14	3,171
17	Z3-1ST FLR SOUTH	1	1	3,430	3,430	2,352	0	0	0	o	0	0	2,475
Zone	17 Total/Ave.			•	3,430	2,352	0	0	0	. 0	0	0	2,475
18	Z3-2ND FLR SOUTH	1	1	5,763	5,763	3,444	0	0	0	5,763	0	0	3,348
Zone	18 Total/Ave.			-	5,763	3,444	0	0	Ō	5,763	0	0	3,348
19	Z1-2ND FLR SOUTH	1	1	2,077	2,077	930	0	0	0	2,077	0	0	2,313
Zone	19 Total/Ave.			-	2,077	93 0	0	0	0	2,077	Ō	0	2,313
20	Z2-2ND FLR SOUTH	1	1	5,681	5,681	2,220	0	0	0	5,681	0	0	3,393
Zone	20 Total/Ave.				5,681	2,220	0	0	0	5,681	0	0	3,393
System	3 Total/Ave.				36,710	41,631	0	0	0	13,521	501	3	17,378
Building	I				60,840	74,509	0	0	0	21,991	501	1	33,393

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1 BASELINE BUILDING 300

System Totals

Percent	Cool	ling Loa	d	Heati	ng Load		Cooling	Airflo	w	Heating	Airflo	w
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	11.0	0	0	-120,956	22	946	10,985.4	0	0	0.0	0	0
5 - 10	22.0	0	0	-241,912	19	817	21,970.8	0	0	0.0	0	0
10 - 15	33.1	0	0	-362,869	15	659	32,956.2	0	0	0.0	0	0
15 - 20	44.1	10	872	-483,825	12	519	43,941.6	0	0	0.0	0	0
20 - 25	55.1	17	1,491	-604,781	13	556	54,927.0	0	0	0.0	0	0
25 - 30	66.1	12	1,025	-725,737	8	364	65,912.4	0	0	0.0	0	0
30 - 35	77.2	7	624	-846,693	6	238	76,897.8	0	0	0.0	0	0
35 - 40	88.2	9	801	-967,650	. 5	218	87,883.2	0	0	0.0	0	0
40 - 45	99.2	5	448	-1,088,606	0	0	98,868.6	0	0	0.0	0	0
45 - 50	110.2	8	730	-1,209,562	0	0	109,854.0	0	0	0.0	0	0
50 - 55	121.2	7	593	-1,330,518	0	0	120,839.4	0	0	0.0	0	0
55 - 60	132.3	5	427	-1,451,474	0	0	131,824.8	0	0	0.0	0	0
60 - 65	143.3	5	438	-1,572,431	0	0	142,810.2	0	0	0.0	0	0
65 - 70	154.3	5	432	-1,693,387	0	0	153,795.6	0	0	0.0	0	0
70 - 75	165.3	3	235	-1,814,343	0	0	164,781.0	0	0	0.0	o	0
75 - 80	176.4	2	212	-1,935,299	0	0	175,766.4	0	0	0.0	0	Ō
80 - 85	187.4	2	154	-2,056,255	0	0	186,751.8	0	0	0.0	0	Ō
85 - 90	198.4	2	150	-2,177,211	0	0	197,737.2	0	0	0.0	0	0
90 - 95	209.4	1	108	-2,298,168	0	0	208,722.6	0	0	0.0	0	0
95 - 100	220.4	0	20	-2,419,124	0	0	219,708.0	100	8,760	0.0	0	0
Hours Off	0.0	0	0	0	0	4,443	0.0	0	0	0.0	0	8.760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

MONTHLY FNERGY CONSUM	PΤ	LON	•
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	ELEC	DEMAND	GAS		GAS DMND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(k₩h)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)
Jan	356,352	648	6,458	140	14
Feb	322,568	648	5,227	130	14
March	365,567	670	2,512	178	8
April	360,455	704	585	224	3
May	391,852	720	9	321	0
June	396,768	742	0.	381	0
July	413,814	751	0	416	0
Aug	415,790	746	0	404	0
Sept	381,326	723	0	318	0
Oct	378,301	705	782	246	4
Nov	350,087	668	2,815	171	9
Dec	356,842	653	5,163	151	11
Total	4,489,721	751	23,551	3,080	14

Building Energy Consumption = Source Energy Consumption =

290,571 (8tu/Sq Ft/Year)

Floor Area =

60,840 (Sq Ft)

= 291,768 (Btu/Sq Ft/Year)

Zmonthly KW= 4 8,378

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------UTILITY PEAK CHECKSUMS-----

Utility ELECTRIC DEMAND

Peak Value 751.4 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

•			
Eqp.		Utility	Percnt
Ref.	Equipment	Demand	Of Tot
Num.	Code Name	Equipment Description (kW)	(%)
Cooling	Equipment		
1	EQ1070L	WTR-CLD RECIP >30 TONS 90.0	11.98
2	EQ1001S	2-STG CTV <555 TONS 114.6	15.26
Sub Total	ι	204.6	27.24
Sub Total	ι	0.0	0.00
Air Movi	ng Equipment		
1		SUMMATION OF FAN ELECTRICAL DEMAND 48.5	6.45
2		SUMMATION OF FAN ELECTRICAL DEMAND 33.6	4.47
3		SUMMATION OF FAN ELECTRICAL DEMAND 119.4	15.89
Sub Total	ι	201.4	26.81
Sub Total	ι	0.0	0.00
Miscellar	neous		
Lights		109.1	14.53
Base Uti	ilities	0.0	0.00
Misc Equ	<i>u</i> ipment	236.2	31.43
Sub Total	l	345.3	45.96
Grand Tot	tal	751.4	100.00

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

			hite Sands Missile Range		REGION:	4	PROJECT NO:	DACA 63-91-C-0152
			E: BLDG. 300 - MODIFIE	ED CONFIGURA	ATION		FISCAL YEAR:	1992
		DISCRETE POR	TION NAME: TOTAL					
		ANALYSIS DATE	10/22/92		ECONOMIC LIFE:	15	PREPARED BY:	T. FORSTER
	1813	(FOTMENT						
1		VESTMENT			·			
		CONSTRUCTION	N COST	=			\$446,296	
		SIOH COST		(5.5% of 1A) =			\$24,546	
		DESIGN COST	_	(6.0% of 1A) =			\$26,778	
		ENERGY CREDI	,	1A + 1B + 1C) =			\$497,620	
		SALVAGE VALU		=			\$0	
	F.	TOTAL INVESTM	MENT	(1D – 1E) =			 >	\$497,620
2	ΕN	IERGY SAVINGS ((+) / COST (-)					
_	,	FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)			
	Δ	ELEC	\$6.48	4,745		FACTOR (4)	SAVINGS (5)	
		DIST	Ψ0.40	4,745	\$30,723	10.79	\$331,501	
		NAT GAS	\$2.21	743	\$0	11.57	\$0	
		PAPER	φ2.21		\$1,644	12.38	\$20,353	
		COAL		0	\$0	44.05	\$0	
		TOTAL		5 400	\$0	11.35	\$0	
	٠.	TOTAL		5,488	32,367.0		>	\$351,854
3	NO	N-ENERGY SAVI	INGS (+) / COST (-)			•		
			RRING (+/-) (ELECT. DEM	IAND SAVINGS	=		671 410	
			NCE COST SAVINGS)		_		\$71,413	
		1 DISCOUNT FA	•		(From Table A-2) ≠	10.67		
			SAVINGS (+) / COST (-)		$(3A \times 3A1) =$	10.07	\$761.070	
	В.	NON-RECURRIN			(0// 0//) =		\$761,979	
		ITEM	()		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)		
		a. Utility rebate		\$54,788	0000111121102 (2)	0.96	SAVINGS (4)	
		b.		\$0		0.00	\$52,596	
		c.		\$0		0.00	\$0	
		d TOTAL		\$54,788	•	0.00	\$0 \$53.506	
	C.		ERGY DISCOUNTED SA		ST (_)	(3A2 + 3Bd4) =	\$52,596	4044.570
		PROJECT NON-			,	(SA2 + SBU4) =		\$814,576
			M NON-ENERGY CALCU	I ATION		(055 × 0.00)	# 110.110	
			THEN GO TO 4	LATION		$(2F5 \times 0.33) =$	\$116,112	
			THEN CALCULATE SIR			(0EE : 0D4) / 4E		
			THEN GO TO 4			(2F5 + 3D1) / 1F =	0.94	
			THEN PROJECT DOES N	OT QUALIEV				
4	FIF	RST YEAR DOLLA	R SAVINGS (+) / COSTS (-)	(2F3	+ 3A + (3B1d/15)) =		\$105,972
5	TO	TAL NET DISCOU	INTED SAVINGS			(2F5 + 3C) =		\$1,166,430
6	DIS	SCOUNTED SAVIN	IGS-TO-INVESTMENT F	RATIO (SIR)		(5/1F) =		2.34
	(IF	SIR < 1 THEN P	ROJECT DOES NOT QUA	LIFY)		•		
7	SIN	IPLE PAYBACK (S	SPB)			(1F/4) =		4.70
						. ,		

CONSTRUCTION COST ESTIMATE BREAKDOWN

ACCOMPTION CONTINUED PARTY VAV. LIGHTING AND THEPAMA. STORAGE ACCOMPTION CONTINUED PARTY VAV. LIGHTING AND THEPAMA. STORAGE CONSOLIDATED CHILLER PLANTY VAV. LIGHTING AND THE CANAGE									-		
PROJECT NUMBER WORK LOCATION	CONTRA	EMC ENGINEERS INC.			ADDHESS 2750 SOUT	TH WADSWORI	TH BLVD., #C	-200, DENVE	R, CO 80227		
MATERIAL COST WORK LOCATION WORK LOCATION WATERIAL COST WHITE SANDS MISSILE FRANGE, NEW MEXICO LABOR COSTS CASTS	CONTRACT	OR (Work to be performed)	BLDG 300 ECIP F	PACKAGE				PROPOSED TOTA	L CONTRACT PRICE		
NOTE LOCATION NOTE	CONSOLI	DATED CHILLER PLANT, VAV, LIGHTING AND THE	RMAL STOR	AGE							
Unit	PURCHASE F	HEQUEST NUMBER			PROJECT NUM	BER		WORK LOCATION	AG E ISOM S	NOE NOW YOU	
CONSOLIDATED CHILLER PLANT Constant Co					MATERIA	COST		LABOR COSTS	NI SOILE DA	NOE, NEW ME	
No.			Chit							Other	
NO. (1) Massure (2) (2) (3) (4) (5) (6) (7) (9) (7) (9) (9) (9) (9) (9) (9) (9) (9) (9) (9	Line	ttem	Jo	Quantity			Manhours	Average		Direct	Line
CONSOLIDATED CHILLER PLANT	N _o		Measure		Unit	Total	Mandays	Rate	Total	Costs	Total
CONSOLIDATED CHILLER PLANT		Ξ	(2)	(3)	€	(2)	(9)	8	(8)	(6)	(10)
DUAL-DUCT VARIABLE-AIR-VOLUME ON AHU EA 1 15384.0 35228.0 8		CONSOLIDATED CHILLER PLANT	EA	-			Cost includes	Material & La	bor w/ Overhea	d & Profit	\$56,100.0
LOW WATTAGE LAMPS AND BALLASTS		DUAL-DUCT VARIABLE-AIR-VOLUME ON AHU		-		177384.0			35228.0		\$268,913.0
1000 TONL-HR THERMAL STORAGE EA 1 LS 248853.9 58841.1 \$ TOTAL THIS SHEET 248853.9 58841.1 \$ Markial Source: Lightbut Supply Co., Darwer, CO.; Haynes Train Co., Direct, CO.; Mares Benthall & Machinistic Cent Disal, Sozie Labor Supply Co., Darwer, CO.; Haynes Train Co., Direct, CO.; Mares Benthall & Machinistic Cent Disal, Sozie Labor Supply Co., Darwer, CO.; Haynes Train Co., Direct, CO.; Mares Benthall & Machinistic Cent Disal, Sozie Labor Supply Co., Darwer, CO.; Haynes Train Co., Direct, Co.; Mares Benthall & Machinistic Cent Disal, Sozie Labor Supply Co., Darwer, CO.; Mares Benthall & Machinistic Cent Disal, Sozie Labor Supply Co., Darwer, CO.; Mares Benthall & Machinistic Cent Disal, Sozie Labor Supply Co., Darwer, CO.; Mares Benthall & Machinistic Cent Disal, Sozie Labor Supply Co., Darwer, CO.; Mares Benthall & Machinistic Cent Disal, Sozie Labor Supply Co., Darwer, CO.; Mares Train Co.; Darwer, CO.; Mares Benthall & Machinistic Cent Disal, Sozie Labor Supply Co., Darwer, CO.; Mares Darwer, CO.; Mares Darwer, CO.; Mares Benthall & Machinistic Cent Disal, Sozie Labor Supply Co., Darwer, CO.; Mares Darwer, CO.; Mares Benthall & Machinistic Cent Disal, Sozie Labor Supply Co., Darwer, CO.; Mares Darwer, CO.; Mares Benthall & Machinistic Cent Disal, Sozie Labor Supply Co., Darwer, CO.; Mares Benthall & Machinistic Cent Disal, Sozie Cent		LOW WATTAGE LAMPS AND BALLASTS		_	rs	15369.9			23413.1		\$38,783.0
TOTAL THIS SHEET		1000 TON-HR THERMAL STORAGE	EA		SI						\$82,500.0
TOTAL THIS SHEET	D1										
Material Source: Lightbulb Supply Co., Darver, CO; Hayres Trane Co., Dirver, CO; Hayres Electrical & Mechanists (202), Mal., costs incided 25% Overhead & Profit; Labor Bou oct. U.S. Dept of Lab., General Wage Deptor Co.	4-2	TOTAL THIS SHEET				248853.9			58641.1		\$446,296.0
Material Source: Lightbuth Supply Co., Derver, CO; Haynes Trais Co., Dirver, CO; Means Bearlical & Mechanical Cost Data, 1922; Mat. costs include 25% Overhead & Profit; Labor Soul es: U.S. Dept. of Lab., General Wage Depision No. NM91-1											
Material Source: Lighthub Supply Co., Derver, Co.; Haynes Trane Co., Dirver, Co.; Means Electrical & Mechanical Cost Data, 1922; Mat. costs incides 25% Overhead & Prolit; Labor Sou joe: U.S. Dept. of Laby, General Wage De jolion No. NM81-1											
Material Source: Lightbulb Supply Co., Denver, Co; Haynes Tranc Co., Dinver, CO; Means Electrical & Mechanical Cost Data, 1992; Mat. costs Include 28% Overhead & Prolit; Labor Sou oe: U.S. Dept. of Labor, General Wage De											
Material Source: Lightbulb Supply Co., Denver, CO; Haynes Trane Co., Dinver, CO; Means Electrical & Mechanical Cost Data, 1992; Mat. costs Include 25% Overhead & Prolit; Labor Sou per: U.S. Dept. of Labor, General Wage De jasion No. NM91-1											
Material Source: Lightbulb Supply Co., Denver, CO; Haynes Trane Co., Dignver, CO; Means Electrical & Mechanical Cost Data 1992; Mat. costs include 25% Overhead & Profit; Labor Sou ce: U.S. Dept. of Labor, General Wage Debision No. NM91-1											
Material Source: Lightbulb Supply Co., Denver, CO; Haynes Trane Co., Denver, CO; Haynes Trane Co., Denver, CO; Means Electrical & Mechanical Cost Data 1992; Mat. costs Include 25% Overhead & Profit; Labor Sou ce: U.S. Dept. of Labor, General Wage Debision No. NM91-1	!										
Material Source: Lightbulb Supply Co., Denver, CO; Haynes Trane Co., Denver, CO; Means Electrical & Mechanical Cost Data 1992; Mat. costs include 25% Overhead & Profit; Labor Sou ce: U.S. Dept. of Labor, General Wage De Sision No. NM91-1											
Material Source: Lightbulb Supply Co., Denver, CO; Haynes Trane Co., Denver, CO; Means Electrical & Mechanical Cost Data, 1992; Mat. costs Include 25% Overhead & Profit; Labor Source: U.S. Dept. of Lador, General Wage Debision No. NM91-1											
Material Source: Lightbulb Supply Co., Denver, CO; Haynes Trane Co., Denver, CO; Means Electrical & Mechanical Cost Data, 1992; Mat. costs include 25% Overhead & Profit; Labor Source: U.S. Dept. of Labor, General Wage Debision No. NM91-1											
		Material Source: Lightbulb Supply Co., Denver, CO; Haynes Trane Co., D.	nver, CO; Means	Electrical & Mech	anical Cost Data	1992; Mat. costs incl.	ide 25% Overhead	& Profit; Labor Sou	ce: U.S. Dept. of Lab	or, General Wage De	deion No. NM91-1

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

							. (2011)	
		LOCATION: White	te Sands Missile	Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	BLDG. 300 - M	IODIFIED CONFIGURA	TION WO/THERMAL S	TORAGE	FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL				
		ANALYSIS DATE:	10/22/92		ECONOMIC LIFE:	15	PREPARED BY:	T. FORSTER
1	INV	VESTMENT						
		CONSTRUCTION	COST	=			\$92 E00	
		SIOH COST		(5.5% of 1A) =			\$82,500	
		DESIGN COST		(6.0% of 1A) =			\$4,538 \$4,950	
	D.			(1A + 1B + 1C) =			\$91,988	
	Ε.	SALVAGE VALUE		=			\$0	
		TOTAL INVESTME	NT	(1D - 1E) =			 >	\$91,988
				(<u>_</u> ,				φ31,300
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	Α.	ELEC	\$6.48	(21)	(\$136)	10.79	(\$1,466)	
	В.	DIST		0	\$0	11.57	\$0	
		NAT GAS	\$2.21	0	\$0	12.38	\$0	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	11.35	\$0	
	F.	TOTAL		(21)	(135.8)		>	(\$1,466)
3		N-ENERGY SAVIN						
	Α.			T. DEMAND SAVINGS	=		\$25,019	
		AND MAINTENANG		GS)				
		1 DISCOUNT FAC			(From Table A-2) =	10.67		
	В	2 DISCOUNTED S		ST (-)	$(3A \times 3A1) =$		\$266,947	
	₽.	NON-RECURRING	i (+/-)					
		I I EIVI		641/11/66 /40	YEAR OF	DISCOUNT	DISCOUNTED	
		a. Utility rebate		SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		b.		\$54,788		0.96	\$52,596	
		с.		\$0		0.00	\$0	
		d TOTAL		\$0		0.00	\$0	
	С	·	BOY DISCOUNT	\$54,788 ED SAVINGS (+) / COS	T ()	(212 221)	\$52,596	
		PROJECT NON-EI		ED SAVINGS (+) / COS	i (-)	(3A2 + 3Bd4) =		\$319,544
	-	1 25% MAXIMUM		CALCULATION		(055 0.00)	(440.4)	
		a IF 3D1 => 3C T	,	DALOGEATION		(2F5 x 0.33) =	(\$484)	
		b IF 3D1 < 3C TH		≣ SIB		(2F5 + 3D1) / 1F =	0.00	
		c IF 3D1b => 1 T		2 0		(213 + 301) / 17 =	-0.02	
		d IF 3D1b < 1 TH	IEN PROJECT D	OES NOT QUALIFY				
4	FIR	ST YEAR DOLLAR	SAVINGS (+) / Co	OSTS (-)	(2F3 -	+ 3A + (3B1d/15)) =		\$27,074
		TAL NET DISCOUN			•	(2F5 + 3C) =		\$318,078
6	DIS	COUNTED SAVING	S-TO-INVESTM	MENT RATIO (SIR)		(5/1F) =		3.46
	(IF	SIR < 1 THEN PRO	JECT DOES NO	T QUALIFY)		, .		
7	SIM	IPLE PAYBACK (SP	В)			(1F/4) =		3.40
						•		

LIFE CYCLE COST ANALYSIS SUMMARY **ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

		LOCATION: Whit	e Sands Missile	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				MOD. CONFIG. W/O VAI		SYSTEMS ON AHUS	FISCAL YEAR:	1992
		DISCRETE PORTIO		TOTAL				
		ANALYSIS DATE:	10/22/92		ECONOMIC LIFE:	15	PREPARED BY:	T. FORSTER
1	IN۱	VESTMENT						
	A.	CONSTRUCTION	COST	=			\$268,913	
	В.	SIOH COST		(5.5% of 1A) =			\$14,790	
	C.	DESIGN COST		(6.0% of 1A) =			\$16,135	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$299,838	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$299,838
2	ΕN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	3,940	\$25,514	10.79	\$275,300	
	В.	DIST		0	\$0	11.57	\$0	
	C.	NAT GAS	\$2.21	761	\$1,684	12.38	\$20,843	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	11.35	\$0	
	F.	TOTAL		4,701	27,198.0		>	\$296,143
3	NO	N-ENERGY SAVIN	GS (+) / COST (-)				
	A.	ANNUAL RECURP	IING (+/-) (ELEC	C. DEMAND SAVINGS)	=		\$17,336	
		1 DISCOUNT FAC			(From Table A−2) =	10.67		
		2 DISCOUNTED S		OST (-)	$(3A \times 3A1) =$		\$184,970	
	В.	NON-RECURRING	3 (+/−)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		C.		\$0		0.00	\$0	
	_	d TOTAL	DOV DISCOUN	\$0	T ()	(240 · 2844)	\$0	\$184.070
		PROJECT NON-E		TED SAVINGS (+) / COS) (-)	(3A2 + 3Bd4) =		\$184,970
	U.	1 25% MAXIMUM		CALCULATION		(2EE v 0 22) -	¢07 707	
		a IF 3D1 => 3C1		CALCULATION		(2F5 x 0.33) =	\$97,727	
		b IF 3D1 < 3C Ti		TE SIR		(2F5 + 3D1) / 1F =	1.31	
		c IF 3D1b => 1 T		. 2 0		(213+001)/11 =	1.51	
				DOES NOT QUALIFY				
								
4	FIF	RST YEAR DOLLAR	SAVINGS (+) / (COSTS (-)	(2F3	+ 3A + (3B1d/15)) =		\$44,533
		TAL NET DISCOUN		()	(2.0	(2F5 + 3C) =		\$481,113
		SCOUNTED SAVING		MENT RATIO (SIR)		(5/1F) =		1.60
		F SIR < 1 THEN PRO		, ,		()		
7		MPLE PAYBACK (SF		,		(1F/4) =		6.73
		`	•			` '		-

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: White Sands Missile Range REGION: 4 PROJECT NO. DACA 43-91-Q-0182				d.					
DISCRETE PORTION NAME: 10/22/92 PREPARED BY: T. FORSTER					_			PROJECT NO:	DACA 63-91-C-0152
INVESTMENT					- MODIFIED CONFIG. W/	O ENERGY EFFICIENT	LIGHTING	FISCAL YEAR:	1992
1 INVESTMENT A. CONSTRUCTION COST			DISCRETE PORTI	ON NAME:	TOTAL				
B. SIOH COST S. SHON COST S.			ANALYSIS DATE:	10/22/92	:	ECONOMIC LIFE:	25	PREPARED BY:	T. FORSTER
B. SIOH COST S.									
B. SIOH COST (5.5% of 1A) = \$2.133 C. DESIGN COST (6.0% of 1A) = \$2.327 D. ENERGY CREDIT (1A + 1B + 1C) = \$43.243 E. SALVAGE VALUE = \$343.243 E. SALVAGE VALUE = \$343.243 E. SALVAGE VALUE = \$343.243 2 ENERGY SAVINGS (+) / COST (-) FUEL TYPE FUEL COST SAVINGS ANNUAL \$DISCOUNT DISCOUNTED \$43.243 2 ENERGY SAVINGS (+) / COST (-) FUEL TYPE FUEL COST SAVINGS ANNUAL \$DISCOUNT DISCOUNTED \$43.243 3 NON-ENERGY SAVINGS (+) / COST (-) FUEL TYPE SAVINGS (-) / COST (-) B. DIST 0 \$0 \$0 \$17.28 \$0 C. NAT GAS \$2.21 (28) (561) \$19.64 (51.195) D. PAPER 0 \$50 \$16.22 \$0 E. COAL \$0 \$0 \$16.22 \$0 F. TOTAL 49 437.6 \$50 \$16.22 \$0 F. TOTAL 49 437.6 \$50 \$16.22 \$0 F. TOTAL \$50 \$16.20 \$1 F. TOTAL \$50 \$16.20 \$10 \$10 \$10 \$10 \$10 \$10 \$10 \$10 \$10 \$1	1	IN۱	VESTMENT						
C. DESIGN COST (6.0% of 1A) = \$2.227 D. ENERGY CREDIT (11A + 1B + 1C) = \$43,243 E. SALVAGE VALUE = \$ \$0 F. TOTAL INVESTMENT (1D - 1E) = \$43,243 2 ENERGY SAVINGS (+) / COST (-) FUEL TYPE FUEL COST SAVINGS ANNUALS DISCOUNT DISCOUNTED \$4MBTU (1) MBTU/YR (2) SAVINGS (3) FACTOR (4) SAVINGS (5) A. ELEC \$6.48 777 \$498 15.23 \$7.592 B. DIST 0 \$50 17.28 \$0 C. NAT GAS \$2.21 (28) (551) 19.64 (51,195) D. PAPER 0 \$50 17.28 \$0 F. TOTAL 49 437.6 \$50 16.22 \$0 F. TOTAL 49 437.6 \$50 16.22 \$0 F. TOTAL 49 437.6 \$50 16.22 \$0 SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) = \$5.655 1 DISCOUNT FACTOR (From Table A-2) = 14.68 2 DISCOUNTED SAVINGS (+) / COST (-) B. NON-RECURRING (+/-) (ELEC. DEMAND SAVINGS) = \$83,015 B. NON-RECURRING (+/-) (ELEC. DEMAND SAVINGS) COCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$30 0.00 \$50 b. \$50 0.00 \$50 c. \$30 0.00 \$50 d TOTAL \$50 0.00 \$50 C TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3B44) = \$83,015 D. PROJECT NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3B44) = \$83,015 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 × 0.33) = \$2,111 a IF 3D1 = 3C THEN QO TO 4 b IF 3D1 < 3C THEN QO TO 4 b IF 3D1 < 3C THEN QO TO 4		A.	CONSTRUCTION	COST	=			\$38,783	
D. ENERGY CREDIT (1A + 1B + 1C) = \$43,243 E. SALVAGE VALUE = \$30 F. TOTAL INVESTMENT (1D − 1E) = \$43,243 2 ENERGY SAVINGS (+) / COST (-) FUEL TYPE FUEL COST SAVINGS ANNUAL S DISCOUNT DISCOUNTED SAVINGS (1) / COST (-) SMBTU (1) MBTU/YR (2) SAVINGS (3) FACTOR (4) SAVINGS (5) A. ELEC \$6.48 77 \$498 15.23 \$7.592 B. DIST 0 0 \$50 17.28 \$50 C. NAT GAS \$2.21 (28) (361) 19.64 (\$1.195) D. PAPER 0 \$50 16.22 \$50 F. TOTAL 49 437.6 \$50 16.22 \$50 F. TOTAL 49 437.6 \$50 16.22 \$50 F. TOTAL 49 437.6 \$50 16.22 \$50 F. TOTAL 49 A37.6 \$50 16.22 \$50 F. TOTAL 50 50 50 16.22 \$50 F. TOTAL 50 50 50 16.22 \$50 F. TOTAL 50 50 50 50 50 F. TOTAL 50 50 50		В.	SIOH COST		(5.5% of 1A) =			\$2,133	
E. SALVAGE VALUE		C.	DESIGN COST		(6.0% of 1A) =			\$2,327	
F. TOTAL INVESTMENT (1D - 1E) = \$		D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$43,243	
2 ENERGY SAVINGS (+) / COST (-) FUEL TYPE FUEL COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED SAVINGS (5) SMBTU (1) MBTU/YR (2) SAVINGS (3) FACTOR (4) SAVINGS (5) A. ELEC \$6.48 77 \$498 15.23 \$7.592 B. DIST 0 \$0 \$50 17.28 \$0 C. NAT GAS \$2.21 (28) (361) 19.64 (\$1,195) D. PAPER 0 \$50 16.22 \$0 F. TOTAL 49 437.6 \$0 16.22 \$0 SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) = \$5,655 1 1 DISCOUNT FACTOR (From Table A-2) = 14.68 \$33.015 B. NON-RECURRING (+/-) ITEM SAVINGS (+) / COST (-) (3A X 3A1) = \$33.015 B. NON-RECURRING (+/-) ITEM SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3B44) = \$33.015 C. TOTAL NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN GO TO 4 b IF 3D1 > 3C THEN GO TO 4 b IF 3D1 > 3C THEN GO TO 4		E.	SALVAGE VALUE		=			\$0	
FUEL TYPE		F.	TOTAL INVESTME	ENT	(1D - 1E) =	•		>	\$43,243
FUEL TYPE									
\$MBTU(1) MBTU/YR (2) SAVINGS (3) FACTOR (4) SAVINGS (5) A. ELEC	2	ΕN	ERGY SAVINGS (+)	/ COST (-)					
A. ELEC \$6.48 77 \$498 15.23 \$7.592 B. DIST 0 \$0 \$0 17.28 \$0 C. NAT GAS \$2.21 (28) (561) 19.64 (\$1,195) D. PAPER 0 \$0 \$0 \$0 \$0 E. COAL \$0 \$0 16.22 \$0 F. TOTAL 49 437.6 \$0 16.22 \$0 SONN-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) = \$5,655 1 DISCOUNT FACTOR (From Table A-2) = 14.68 2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = \$83,015 B. NON-RECURRING (+/-) (ELEC. DEMAND SAVINGS) YEAR OF DISCOUNT DISCOUNTED ITEM \$\$SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$33,015 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$33,015 D. PROJECT NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 <> THEN GO TO 4			FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
B. DIST 0 \$0 \$0 17.28 \$0 C. NAT GAS \$2.21 (28) (\$61) 19.64 (\$1,195) D. PAPER 0 \$0 \$0 \$0 \$0 E. COAL \$0 \$16.22 \$0 F. TOTAL 49 437.6 \$0 16.22 \$0 A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) = \$5,655 1 DISCOUNT FACTOR (From Table A-2) = 14.68 2 DISCOUNTED SAVINGS (+) / COST (-) B. NON-RECURRING (+/-) ITEM YEAR OF DISCOUNT DISCOUNTED SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 \$0 \$0.00 \$0 b. \$0 \$0.00 \$0 c. \$0 \$0.00 \$0 d TOTAL \$0 \$0 \$0.00 \$0 c. \$0 \$0.00 \$0 d TOTAL \$0 \$0 \$0.00 \$0 c. \$0 \$0 \$0.00 \$0 D. PROJECT NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) \$32 + 3844) = \$33,015 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN GO TO 4				\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
C. NAT GAS \$2.21 (28) (\$61) 19.64 (\$1,195) D. PAPER 0 \$0 \$0 \$0 \$0 E. COAL \$0 \$16.22 \$0 F. TOTAL 49 437.6 \$> \$6,396 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) = \$5,655 1 DISCOUNT FACTOR (From Table A-2) = 14.68 2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = \$83,015 B. NON-RECURRING (+/-) ITEM YEAR OF DISCOUNT DISCOUNTED SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$50 0.00 \$0 d TOTAL \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$83,015 D. PROJECT NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN GO TO 4		A.	ELEC	\$6.48	77	\$498	15.23	\$7,592	
D. PAPER 0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$		В.	DIST		0	\$0	17.28	\$0	
E. COAL F. TOTAL 49 437.6 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) 1 DISCOUNT FACTOR 2 DISCOUNTED SAVINGS (+) / COST (-) B. NON-RECURRING (+/-) 1TEM 7 YEAR OF 1 DISCOUNT 1 DISCOUNT DISCOUNTED SAVINGS (1) 1 OCCURRENCE (2) 1 DISCOUNT 1 DISCOUNTED SAVINGS (1) 1 DISCOUNT 1 DISCOUNT 1 DISCOUNTED SAVINGS (1) 2 DISCOUNTED SAVINGS (1) 3 SAVINGS (4) A. \$0 0.00 50 0. \$0 0.00 50 0. \$0 0.00 50 0. \$0 0.00 50 0. \$0 0.00 50 0. \$0 0.00 50 0. \$0 0.00 50 0. \$0 0.00 50 0. \$		C.	NAT GAS	\$2.21	(28)	(\$61)	19.64	(\$1,195)	
F. TOTAL 49 437.6 3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) 1 DISCOUNT FACTOR 2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = \$83,015 B. NON-RECURRING (+/-) ITEM YEAR OF DISCOUNT DISCOUNTED SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$83,015 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN GALOULATE SIR (2F5 + 3D1) / 1F = 0.20 c IF 3D1b => 1 THEN GO TO 4		D.	PAPER		0	\$0		\$0	
3 NON-ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) = \$5,655 1 DISCOUNT FACTOR (From Table A-2) = 14.68 2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = \$83,015 B. NON-RECURRING (+/-) ITEM YEAR OF DISCOUNT DISCOUNTED SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$83,015 C. TOTAL NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 = 3 C THEN GO TO 4 b IF 3D1 < 3C THEN GO TO 4 c IF 3D1b => 1 THEN GO TO 4		E.	COAL			\$0	16.22	\$0	
A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) = \$\$5,655 1 DISCOUNT FACTOR (From Table A-2) = 14.68 2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = \$\$83,015 B. NON-RECURRING (+/-) ITEM YEAR OF DISCOUNT DISCOUNTED SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 O.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$\$83,015 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.20 c IF 3D1b => 1 THEN GO TO 4		F.	TOTAL		49	437.6		>	\$6,396
A. ANNUAL RECURRING (+/-) (ELEC. DEMAND SAVINGS) = \$5,655 1 DISCOUNT FACTOR (From Table A-2) = 14.68 2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = \$83,015 B. NON-RECURRING (+/-) ITEM YEAR OF DISCOUNT DISCOUNTED SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 O.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$83,015 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.20 c IF 3D1b => 1 THEN GO TO 4									
1 DISCOUNT FACTOR (From Table A-2) = 14.68 2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = \$83,015 B. NON-RECURRING (+/-) ITEM YEAR OF DISCOUNT DISCOUNTED SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$83,015 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.20 c IF 3D1b => 1 THEN GO TO 4	3	NO	N-ENERGY SAVIN	GS (+) / COST	(-)				
2 DISCOUNTED SAVINGS (+) / COST (-) (3A x 3A1) = \$83,015 B. NON-RECURRING (+/-) ITEM YEAR OF DISCOUNT DISCOUNTED SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$83,015 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.20 c IF 3D1b => 1 THEN GO TO 4		A.	ANNUAL RECURF	RING (+/-) (ELI	EC. DEMAND SAVINGS)	=		\$5,655	
B. NON-RECURRING (+/-) ITEM YEAR OF DISCOUNT DISCOUNTED SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$83,015 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.20 c IF 3D1b => 1 THEN GO TO 4			1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
TEM			2 DISCOUNTED S	SAVINGS (+) /	COST (-)	(3A x 3A1) =		\$83,015	
SAVINGS (1) OCCURRENCE (2) FACTOR (3) SAVINGS (4) a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$83,015 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.20 c IF 3D1b => 1 THEN GO TO 4		В.	NON-RECURRING	3 (+/-)					
a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$83,015 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.20 c IF 3D1b => 1 THEN GO TO 4			ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
a. \$0 0.00 \$0 b. \$0 0.00 \$0 c. \$0 0.00 \$0 d TOTAL \$0 0.00 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$83,015 D. PROJECT NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 <3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.20 c IF 3D1b => 1 THEN GO TO 4					SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
c. \$0 0.00 \$0 d TOTAL \$0 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$83,015 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.20 c IF 3D1b => 1 THEN GO TO 4			a.		\$0		0.00		
d TOTAL \$0 \$0 C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$83,015 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.20 c IF 3D1b => 1 THEN GO TO 4			b.		\$0		0.00	\$0	
C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2 + 3Bd4) = \$83,015 D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.20 c IF 3D1b => 1 THEN GO TO 4			c.		\$0		0.00	\$0	
D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.20 c IF 3D1b => 1 THEN GO TO 4			d TOTAL		\$0			\$0	
D. PROJECT NON-ENERGY TEST 1 25% MAXIMUM NON-ENERGY CALCULATION (2F5 x 0.33) = \$2,111 a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.20 c IF 3D1b => 1 THEN GO TO 4		C.	TOTAL NON-ENE	RGY DISCOU	NTED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$83.015
a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.20 c IF 3D1b => 1 THEN GO TO 4		D.	PROJECT NON-E	NERGY TEST					V ==,
a IF 3D1 => 3C THEN GO TO 4 b IF 3D1 < 3C THEN CALCULATE SIR (2F5 + 3D1) / 1F = 0.20 c IF 3D1b => 1 THEN GO TO 4			1 25% MAXIMUM	NON-ENERG	Y CALCULATION		(2F5 x 0.33) =	\$2,111	
c IF 3D1b => 1 THEN GO TO 4			a IF 3D1 => 3C 1	THEN GO TO	4		,	+=,	
c IF 3D1b => 1 THEN GO TO 4			b IF 3D1 < 3C Th	HEN CALCULA	ATE SIR		(2F5 + 3D1) / 1F =	0.20	
d IE 2014 of THEN PROJECT ROSE NOT ONLY THE			c IF 3D1b => 1 T	HEN GO TO 4	ļ		,		
d IF 3D1b < 1 THEN PROJECT DOES NOT QUALIFY			d IF 3D1b < 1 TH	IEN PROJECT	DOES NOT QUALIFY				
4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3B1d/25)) = \$6,093	4	FIR	ST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$6,093
5 TOTAL NET DISCOUNTED SAVINGS (2F5 + 3C) = \$89,412	5	TO	TAL NET DISCOUN	TED SAVINGS	5		(2F5 + 3C) =		
6 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (5/1F) = 2.07	6	DIS	COUNTED SAVING	S-TO-INVES	TMENT RATIO (SIR)		(5/1F) =		
(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)		(IF	SIR < 1 THEN PRO	DJECT DOES	NOT QUALIFY)				
7 SIMPLE PAYBACK (SPB) (1F/4) = 7.10	7	SIM	IPLE PAYBACK (SP	'B)			(1F/4) =		7.10

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION: Whit	te Sands Missile	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	BLDG. 300 - I	MOD. CONFIG. W/O CO	NSOLIDATED CHILLEI	R PLANT	FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL				
		ANALYSIS DATE:	10/22/92		ECONOMIC LIFE:	25	PREPARED BY:	T. FORSTER
1	IN/	VESTMENT						
		CONSTRUCTION	COST	=			\$56,100	
		SIOH COST		(5.5% of 1A) =			\$3,086	
	C.	DESIGN COST		(6.0% of 1A) =			\$3,366	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$62,552	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	ENT	(1D - 1E) =			>	\$62,552
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	617	\$3,995	15.23	\$60,839	
	В.	DIST	·	0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	0	\$0	19.64	\$0	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		617	3,994.7		>	\$60,839
3	NC	N-ENERGY SAVIN	IGS (+) / COST	(–)				
	A.	ANNUAL RECURF	RING (+/-) (ELE	C. DEMAND SAVINGS +	=		\$3,212	
		MAINTENANCE C	OST SAVINGS)					
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	SAVINGS (+) / C	OST (-)	$(3A \times 3A1) =$		\$47,152	
	В.	NON-RECURRING	G (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENE	RGY DISCOUN	ITED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$47,152
	D.	PROJECT NON-E	NERGY TEST					
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$20,077	
		a IF 3D1 => 3C	THEN GO TO 4					
		b IF 3D1 < 3C T	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =	1.29	
		c F3D1b => 17	THEN GO TO 4					
		d IF 3D1b < 1 Ti	HEN PROJECT	DOES NOT QUALIFY				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (=)	(2F3	+ 3A + (3B1d/25)) =		\$7,207
		TAL NET DISCOUN			,, 0	(2F5 + 3C) =		\$107,991
				TMENT RATIO (SIR)		(5/1F) =		1.73
		F SIR < 1 THEN PR		` '		(2) =		
7	-	MPLE PAYBACK (SF		·		(1F/4) =		8.68
•			-,			(1174) =		0.00

ESOS STUDY AT WSMR - BUILDING 300
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
BLDG P300: MODIFIED CONFIGURATION

Weather File Code:	ELPASO	o.w
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F) TT
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	~~
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run:

Latent Heat Factor:

Enthalpy Factor:

14:31:55 10/19/92

4,214.8 (Btu-min./hr/cuft)

3.9171 (Lb-min./hr/cuft)

Dataset Name:

nation state

300MF1 .TM

abilitation.

System 1 Block DDVAV - DOUBLE DUCT VAV

************** Peaked at Time			Mo/Hr:	7/16			*	MO/	nr:	1710		110, 111 12	•		
Outside Air =		OAD	B/WB/HR:	97/ 64/ 49.0	1		*	OAI	DB: '	97 * *		OADB: 2	4		
					W	. D	. *	Sn.	ace	Percnt *	Space Po	eak Coil P	eak	Perc	nt
		Space		Ret. Air		t Percni		Sensi		Of Tot *	Space So		ens	Of T	ot
	Sens	.+Lat.	Sensible		Tota			(Bt		(%) *	(Bt		uh)	C	(۵
Envelope Load	s	(Btuh)	(Btuh)		(Btuh)) *	(50	0	0.00 *	•	0	0	0.	00
Skylite Sol	Γ	0	(0	0.00 *		0	0	0.	00
Skylite Con	đ	0	(='			0 * 1 *		0	0.00 *		0 -9,	111	4.	37
Roof Cond		0	10,080		10,08				0	0.00 *		0	0	0.	00
Glass Solar		0	•			0.0	•		0	0.00 *		0	0	0.	00
Glass Cond		0	(0.0		73,	-	32.03 *	-128,	997 -161,	011	86.	09
Wall Cond		73,720	19,023	5	92,74		•			-10.79 *	-60,			32.	
Partition	-	24,826			-24,82			-24,		0.00 *	00,	0	0	0.	
Exposed Flo	ог	0					0 *		0	2.98 *	-14,	-		7.	
Infiltratio	n	5,231			5,23		3 *	•	869		*			131.	
Sub Total==	>	54,125	29,10	5	83,22	30.6	5 *	55,	763	24.23 *	-203,	300 - 543	103		•
Internal Load							*					0	0	0.	nn
Lights		48,829)	48,82			48,		21.22 *			0	0.	
People		27,300			27,30			•	950	6.50 *		0	0	0.	
Misc		103,877	(0	103,87			103,		45.13 *		0	0		00
Sub Total==	> 1	180,006		9 0	180,00	6 66.3	0 *	167,		72.85 *		0	-		00
Ceiling Load		26,344	-26,34	4		0.0	0 *	6,	734	2.93 *			0		
Outside Air		0	(0 0	14,58	2 5.3	7 *		0	0.00 *		0	0		00
Sup. Fan Heat						0.0	0 *			0.00 *			0		00 00
Ret. Fan Heat			1	0		0.0	0 *			0.00 *			-		
Duct Heat Pku			ı	0	_		0 *			0.00	·	•	0		00 00
OV/UNDR Sizin	-	0			ŢŢ	0.0	0 *		0	0.00		0	0		00 06
Exhaust Heat	_		-6,29	7 0	-6,29	7 -2.3	2 *			0.00	•	38,	,089 0	-31.	
Terminal Bypa	ss		1	0 0		0 -0.0	0 *			0.00	•		U	٥.	00
••							*					/4/ 407	044	100.	nn
Grand Total==	> :	260,474	-3,53	7 0	271,51	9 100.0	0 *	230,	153	100.00 *	-228,	416 -187	,010	100.	00
			CO	OLING COIL S	ELECTION							AREAS-			
To	tal Ca	necity	Sens Cap.			ing DB/W	/B/HR			B/WB/HR	Gross To	tal Gla	ss (sf) ())
	ns)	(Mbh)	(Mbh)	(cfm)	Deg F D	eg F Gr	ains	Deg F	Deg f	Grains	Floor	12,065			
_	2.6	271.5	265.2	13,418	_		56.9	53.1	52.1	66.0	Part	17,254			
		0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	0			
	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	4,235		0	0
pt Vent	0.0	271.5	0.0	•	•••						Wall	8,132		0	0
otals 2	22.6	271.5													
НЕ	ATING	COIL SEL	ECTION		A					ENGINEERING		TEMPER		(F): H	
Cap	pacity	Coil A	irfl Ent	Lvg	Type	Coolir	-	Heating		lg % OA	7.0	Туре	Clg 55.0		
	(Mbh)	(cf	m) Deg	F Deg F	Vent	86	66	0		lg Cfm/Sqft	1.03	SADB			
	340.6	4,	942 53.	0 125.0	Infil	32	23	323		lg Cfm/Ton	546.89	Plenum	82.0		7.8 7.7
lux Htg	0.0	·	0 0.	0.0	Supply	12,37	74	4,501		lg Sqft/Ton		Return	82.0		7.7
reheat	-24.1	;	866 24.		Mincfm		0	0		lg Btuh/Sqf1		Ret/OA	83.0		0
eheat	-0.0		0 0.		Return	13,41	18	4,942		o. People	65	Runarnd	74.4		2.0
lumidif	0.0		0 0.		Exhaust	86	56	4,942		tg % OA	0.0	Fn MtrTD			0.0
pt Vent	0.0		0 0.		Rm Exh		0	0		tg Cfm/SqFt		Fn BldTD			0.0
										tg Btuh/SqF	t -30.23	Fn Frict	1.4		0.0

System 2 Block DDVAV - DOUBLE DUCT VAV

	******	*****	****** C	OOLING COIL	PEAK ****	*****	****	****	****	**** CLG	SPACE	PEAK ****	***** HI	EATING CO	IL PEAK	*****	r
		t Time ==		Mo/Hr:					*		/Hr: 7		•		13/ 1		
	Outside	Air ==>	OA.	DB/WB/HR:	97/ 64/ 49.0	0			*	O	ADB: 9	7 1	r	OADB	24		
									*			4	·				
1995 J			Space	Ret. Air	Ret. Air		let	Percnt	*	S	pace	Percnt *	•		il Peak	Percnt	:
		s	ens.+Lat.	Sensible	Latent	Tot	tal	Of Tot	*	Sens	ible	Of Tot	Space :	Sens To	ot Sens	Of Tot	:
i davadādaras viesa	Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btu	ሱ)	(%)	*	(B	tuh)	(%) *	(B	tuh)	(Btuh)	(%)	
	Skylit	e Solr	0	0			0	0.00	*		0	0.00	r	0	0	0.00)
	Skylit	e Cond	0	0			0	0.00	*		0	0.00	r	0	0	0.00	
	Roof C	ond	0	10,261		10,2	261	2.35	*		0	0.00	r	0	-9,103	4.86	دُ
	Glass	Solar	0	0			0	0.00	*		0	0.00	r	0	0	0.00)
	Glass		0	0			0	0.00	*		0	0.00	•	0	0	0.00)
	Wall C		65,647	17,461		83,1	801	19.00	*	65	,647	17.06	-124	,832 -	155,364	83.01	l
	Partit		-27,053	•		-27,0)53	-6.18	*	-27	,053	-7.03	-64	,928	-64,928	34.69)
		d Floor	. 0			-	0	0.00	*		0	0.00	•	0	0	0.00)
	•	ration	6,189			6,1	189	1.41	*	6	,869	1.78	-14,	,848	14,848	7.93	ś
eacht i		tal==>	44,783	27,722		72,5		16.57		45	,463	11.81	-204	,608 -	244,242	130.49	,
Registros estas	Internal					•			*			•	•				
	Lights		59,476	0		59,4	76	13.60	*	59	,476	15.45	•	0	0	0.00)
	People		19,740	•		19,7		4.51			,810	2.81		0	0	0.00)
	Misc		266,323	0	0	266,3		60.88			,323	69.19	r	0	0	0.00)
		tal==>	345,538	0	_	345,5		78.99			,608	87.45	r	0	0	0.00)
•	Ceiling		23,737	-23,737	-	,	0	0.00			.838	0.74		,857	0	0.00	j
	Outside A		0	25,751	_	29,3	-	6.70			0	0.00		0	0	0.00)
	Sup. Fan		•	Ū	•	/-	0	0.00			_	0.00			0	0.00	j
	Ret. Fan			0			0	0.00				0.00			0	0.00	j
	Duct Hea			0			0	0.00				0.00			0	0.00)
Talante grane con	OV/UNDR	•	0	·			ĞΤ	0.00			0	0.00		0	0	0.00)
NAME OF THE OWNER, OF THE OWNER, OF THE OWNER, OF THE OWNER, OWNER, OWNER, OWNER, OWNER, OWNER, OWNER, OWNER,	Exhaust	-	•	-9,930	0	-9,9	- :	-2.27				0.00	•		57,073	-30.49	,
	Terminal			0	0	7,4	0	-0.00				0.00	,		0	0.00	
	161mmer	pypass		·	·		•		*			4	r				
	Grand To	tal==>	414,058	-5,944	0	437,4	44	100.00	*	384	,909	100.00	-228	,465 -	187,169	100.00)
					LING COIL SE	ELECTION-								ARE			
		Total	Capacity	Sens Cap.	Coil Airfl		-	DB/WB/				J/WB/HR	Gross To		ilass (s	f) (%)	
199		(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F	-					Grains	Floor	12,065			
* ***	Main Clg	36.5	437.4	432.3	21,939	82.4	59.		2.3	52.6	51.6	64.6	Part	15,624			
	Aux Clg	0.0	0.0	0.0	0	0.0	0.		0.0	0.0	0.0	0.0	Exflr	0		_	
	Opt Vent	0.0	0.0	0.0	0	0.0	0.	0 0	0.8	0.0	0.0	0.0	Roof	4,235		0 (1
	Totals	36.5	437.4										Wall	7,884		0 (1
				ECTION								NGINEERING				S (F)	
		•	y Coil A		Lvg	Type	С	cooling	H	leating		% OA	7.1	Тур			١
		(Mbh)			Deg F	Vent		1,472		0		Cfm/Sqft	1.73	SADB	55.		
	Main Htg	-420.		941 36.2	125.0	Infil		323		323		Cfm/Ton	571.78	Plenu			
	Aux Htg	0.		0.0	0.0	Supply		20,843		4,502	_	Sqft/Ton	330.97	Retur			
	Preheat	-40.		472 24.0		Mincfm		0		0	_	Btuh/Sqft		Ret/O			
	Reheat	-0.		0.0		Return		21,939		4,941		People	47	Runari			
	Humidif	0.		0.0	0.0	Exhaust		1,472		4,941		% OA	0.0	Fn Mti			
	Opt Vent	0.	0	0.0	0.0	Rm Exh		0		0	-	Cfm/SqFt	0.37	Fn Blo			
principal const	Total	-460.	5			Auxil		0		0	Htg	Btuh/SqFt	-38.17	Fn Fr	ict 1.	8 0.0	,

DDVAV - DOUBLE DUCT VAV System Block Mo/Hr: 7/16 Mo/Hr: 13/ 1 Mo/Hr: 7/16 Peaked at Time ==> OADB: 97 OADB: 24 Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 Percnt * Coil Peak Space Space Peak Percnt Space Ret. Air Ret. Air Net Percnt Sensible Of Tot * Space Sens Tot Sens Of Tot Total Of Tot Sens.+Lat. Sensible Latent (Btuh) (%) (Btuh) (Btuh) (%) (Btuh) (%) (Btuh) (Btuh) (Btuh) Envelope Loads 0.00 0.00 0 0.00 0 0 Skylite Solr 0 0 U 0.00 0 0 0.00 0.00 O Skylite Cond 0 0 0 0.00 O -31,122 6.55 34,240 34,240 3.71 0 Roof Cond 0 0.00 14,028 0 14,028 1.52 14,028 1.76 0 0 Glass Solar 6,931 0.87 -16,967 -16,967 3.57 6,931 0 6,931 0.75 Glass Cond -266,695 -339,542 71.42 131,183 16.45 131,183 38,155 169,338 18.35 Wall Cond -5.67 -149,871 -149,871 31.52 -45,200 -45,200 -45,200 -4.90 Partition 0.00 0 0.00 0 0.00 0 0 Exposed Floor 18,394 2.67 -45,361 -45,361 9.54 1.99 21,270 18,394 Infiltration 16.07 -478,895 -582,864 122.60 21:42 128,211 Sub Total ==> 125,335 72,396 197,731 Internal Loads 193,225 20.93 193,225 24.23 0 0 0.00 193,225 0 Lights 0.00 7.01 35,420 4.44 0 0 64,680 People 64,680 3,208 425,318 46.08 425,318 53.32 3,208 -0.67 Misc 425,318 0 683,223 74.02 653,963 81.99 3,208 3,208 -0.67 Sub Total ==> 683,223 0 58,449 -58,449 0 0.00 15,433 1.93 -67,112 0 0.00 Ceiling Load 0.00 0 0.00 Outside Air 0 0 0 57,720 6:25 0.00 0 0.00 0.00 Sup. Fan Heat 0 0.00 0.00 0.00 Ret. Fan Heat 0 0 0.00 0.00 0 Duct Heat Pkup 0 0 0.00 TTO 0 0.00 0.00 0.00 0 OV/UNDR Sizing -15,643 0.00 104,240 -21.93 -1.69 Exhaust Heat -15,643 Ω 0.00 0 0.00 O -0.00 Terminal Bypass 0 0 100.00 * 100.00 Grand Total==> 867,007 -1,696 923,030 100.00 * 797,607 -542,798 -475,416 ------COOLING COIL SELECTION----------AREAS-----Leaving DB/WB/HR Gross Total Glass (sf) (%) Sens Cap. Coil Airfl Entering DB/WB/HR Total Capacity Deg F Deg F Grains Floor 36,710 (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains 52.2 51.1 Part 41,631 76.9 923.0 905.5 45,144 81.0 59.4 53.5 Main Clg

Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	ExFlr	0			
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	Roof	13,521		0 0	
Totals	76.9	923.0								Wall	17,879	50	1 3	
	HEATING	COIL SELECTIO)N	•••••		AIRFLOWS (d	fm)	ENGIN	EERING	CHECKS	TEMPERA	TURES	(F)	
	Capacity	Coil Airfl	Ent	Lvg	Type	Cooling	Heating	Clg % O	A	7.1	Туре	Clg	Htg	
	(Mbh)	(cfm)	Deg F	Deg F	Vent	3,041	0	Clg Cfm	/Sqft	1.17	SADB	55.0	125.0	
Main Htg	-1,219.0	11,502	14.3	125.0	Infil	987	987	Clg Cfm	/Ton	557.20	Plenum	79.8	62.7	
Aux Htg	0.0	0	0.0	0.0	Supply	42,859	10,69 6	Clg Sqf	t/Ton	477.26	Return	79.8	62.5	
Preheat	-82.0	3,041	24.0	52.2	Mincfm	0	0	Cig Btu	h/Sqft	25.14	Ret/OA	81.0	24.0	
Reheat	-0.0	0	0.0	0.0	Return	45,144	11,502	No. Peo	ple	154	Runarnd	74.4	72.0	
Humidif	0.0	0	0.0	0.0	Exhaust	3,041	11,502	Htg % Q	A	0.0	Fn MtrTD	0.9	0.0	
Opt Vent	0.0	0	0.0	0.0	Rm Exh	0	0	Htg Cfm	/SqFt	0.29	Fn BldTD	0.7	0.0	
Total	-1,301.0				Auxil	0	0	Htg Btu	h/SqFt	-35.44	Fn Frict	2.1	0.0	

BUILDING U-VALUES - ALTERNATIVE 1
MODIFIED CONFIGURATION - BUILDING 300

------ BUILDING U-VALUES------

					Ro	om U-Va	lues				Room	Room
					(Bt	u/hr/sq	ft/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	Z1-BSHT EAST	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
Zone	1 Total/Ave.	0.652	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	234.7	46.30
2	Z1-1ST FLR EAST	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
Zone	2 Total/Ave.	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.456	0.317	104.1	20.20
3	Z2-1ST FLR EAST	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
Zone	3 Total/Ave.	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	76.4	15.07
4	Z1-2ND FLR EAST	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
Zone	4 Total/Ave.	0.169	0.000	0.000	0.000	0.070	0.000	0.000	0.456	0.317	142.8	28.70
5	Z2-2ND FLR EAST	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
Zone	5 Total/Ave.	0.133	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	132.4	26.83
System	1 Total/Ave.	0.393	0.000	0.000	0.000	0.070	0.000	0.000	0.448	0.317	148.3	29.43
6	Z1-BSMT WEST	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
Zone	6 Total/Ave.	0.821	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	235.1	46.60
	ZZ-BSMT WEST	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
Zone	7 Total/Ave.	0.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	403.3	79.96
8		0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
Zone	8 Total/Ave.	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.462	0.317	99.4	19.22
9	Z2-1ST FLR WEST	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
Zone	9 Total/Ave.	0.388	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	74.0	14.73
10		0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
Zone	10 Total/Ave.	0.177	0.000	0.000	0.000	0.070	0.000	0.000	0.462	0.317	144.4	29.16
11		0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
Zone	11 Total/Ave.	0.240	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	134.1	27.41
System	2 Total/Ave.	0.472	0.000	0.000	0.000	0.070	0.000	0.000	0.446	0.317	152.2	30.37
12	Z3-BSMT SOUTH	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
Zone	12 Total/Ave.	0.578	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	273.6	53.77
13	Z2-BSMT SOUTH	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
Zone	13 Total/Ave.	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	196.0	38.34
14	Z1-BSMT SOUTH	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
Zone	14 Total/Ave.	0.590	0.000	0.000	0.000	0.000	0.000	0.000	0.550	0.317	247.9	49.10
15	Z1-1ST FLR SOUTH	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
Zone	15 Total/Ave.	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	96.7	18.97
	Z2-1ST FLR SOUTH	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
Zone	16 Total/Ave.	0.250	0.000	0.000	0.000	0.000	0.653	0.706	0.431	0.317	55.2	10.96
	Z3-1ST FLR SOUTH	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.438	0.317	61.0	11.82
Zone	17 Total/Ave.		0.000			0.000		0.000	0.438	0.317	61.0	11.82
18	Z3-2ND FLR SOUTH	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
Zone	18 Total/Ave.	0.187	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	112.1	23.09
19	Z1-2ND FLR SOUTH	0.237	0.000	0.000	0.000	0.070		0.000	0.438	0.317	141.0	28.94
Zone	19 Total/Ave.	0.237	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	141.0	28.94
_ 20	Z2-2ND FLR SOUTH	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
Zone	20 Total/Ave.	0.151	0.000	0.000	0.000	0.070	0.000	0.000	0.438	0.317	107.3	22.16
System	3 Total/Ave.	0.417	0.000	0.000	0.000	0.070		0.706	0.437	0.317	129.1	25.81
Buildin	9	0.423	0.000	0.000	0.000	0.070	0.653	0.706	0.442	0.317	137.5	27.43

สมอังได้เดิดสังคับ

BUILDING AREAS - ALTERNATIVE 1
MODIFIED CONFIGURATION - BUILDING 300

and the same

BUILDING AREAS -----

							_							
				Floor	Total		Exposed	olustiakė	Skl	Net Roof	Window	Win	Net Wall	
		Numbe	er of	Area/Dupl	Floor	Partition	Floor	Skylight	/Rf	Area	Area	/wt	Area	
Room		Dupli	cate	Room	Area	Area	Area	Area	(%)	(sqft)	(sqft)	(%)	(sqft)	
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(//)	(oqi t)	(04.0)	,	1-4	
				7 505	3,595	8,458	0	0	0	0	0	0	247	
1	Z1-BSMT EAST	1	1	3,595	3,595	8,458	0	0	0	0	. 0	0	247	
Zone	1 Total/Ave.		_	4 505	1,595	2,145	0	0	0	0	0	0	1,368	
2	Z1-1ST FLR EAST	1	1	1,595	1,595	2,145	0	0	0	0	0	0	1,368	
Zone	2 Total/Ave.			2,640	2,640	858	0	0	0	0	0	0	2,574	
3	Z2-1ST FLR EAST	1	1	2,040	2,640	858	0	0	0	0	0	0	2,574	
Zone	3 Total/Ave.			4 505	1,595	3,045	0	0	0	1,595	0	0	1,368	
4.	Z1-2ND FLR EAST	1	1	1,595	1,595	3,045	0	0	O	1,595	0	0	1,368	
Zone	4 Total/Ave.			2.440	2,640	2,748	0	0	0	2,640	0	0	2,574	
5	Z2-2ND FLR EAST	1	1	2,640	2,640	2,748	0	0	0	2,640	0	0	2,574	
Zone	5 Total/Ave.				12,065	17,254	0	0	0	4,235	0	0	8,132	
System	1 Total/Ave.		_	7 200	3,280	5,763	0	0	0	0	0	0	0	
6	Z1-BSMT WEST	1	1	3,280	3,280	5,763	0	0	0	0	0	0	0	
Zone	6 Total/Ave.	_		315	3,200	909	0	0	. 0	.0	0	0	0	
<u>7</u>	Z2-BSMT WEST	1	1	312	315	909	0	0	0	0	. 0	0	0	
Zone	7 Total/Ave.			1,595	1,595	2,784	0	. 0	0	0	0	0	•	
8	Z1-1ST FLR WEST	1	1	1,393	1,595	2,784	0	0	0	0	0	0	•	
Zone	8 Total/Ave.			2,640	2,640	1,080	0	0	0	0	0	0	•	_
9	Z2-1ST FLR WEST	1	1	2,040	2,640	1,080	0	0	0	0	0	0	•	
Zone	9 Total/Ave.		1	1,595	1,595	2,565	0	0	0	1,595	0	0	•	•
10	Z1-2ND FLR WEST	1	•	1,393	1,595	2,565	0	0	0	1,595	0	0	•	
Zone	10 Total/Ave.			2,640	2,640	2,523	0	0	0	2,640	0	0	•	
11	Z2-2ND FLR WEST	1	1	2,040	2,640		0	0	0	2,640	0	0	•	
Zone	11 Total/Ave.				12,065	15,624	0	0	0	4,235	0	0	•	
System	2 Total/Ave.		1	2,202	2,202		0	0	0	0	Ċ) () 0	
	Z3-BSMT SOUTH	1	٠	2,202	2,202		0	0	0	0	C	• (_	
Zone	12 Total/Ave		4	3,780	3,780		0	0	0	0	C) () 0	
13		1	1	3,700	3,780		0	C	0	0	C) (0	
Zone	13 Total/Ave			3,685	3,685		0	C	0	0	() () 49	
14	Z1-BSMT SOUTH	1	1	3,003	3,685		0	(0	0	() (0 49	
Zone	14 Total/Ave			4,089	4,089		0	(0	0	() (0 2,628	
15			1	4,009	4,089		0	. (0	0	() (0 2,628	
Zone	15 Total/Ave		1	6,002	6,002		0	(0	0	5 01		•	
16			•	6,002	6,002		0	(0	0	501	1 14	•	
Zone	16 Total/Ave		1	3,430	3,430		0	(0 (0	() (0 2,475	
	Z3-1ST FLR SOUT		•	3,430	3,430		0) 0	0	1) (0 2,475	
Zone	17 Total/Ave		1	5,763	5,763		0		0 0	5,763	•	0 (0 3,348	
	Z3-2ND FLR SOUT		•	5,105	5,763		0	(0 0	5,763	(0	0 3,348	
Zone	18 Total/Ave		4	2 077	2,077		0		0 0	2,077	(0	0 2,313	
	Z1-2ND FLR SOUT		1	2,077	2,077		0		0 0		1	0	0 2,313	
Zone	19 Total/Ave		_	E 404	5,68		0		0 0			0	0 3,393	
	Z2-2ND FLR SOUT		1	5,681	5,68°		0		0 0			0	0 3,393	
Zone	20 Total/Ave				36,71		0		0 0		50	1	3 17,378	
System		·-			60,84		0		0 0		50	1	1 33,393	3
Buildi	ng				00,04		·							

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1
MODIFIED CONFIGURATION - BUILDING 300

System Totals

Percent	Cool	ing Loa	d	Heatir	ng Load	•••••	Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	6.8	6	482	-106,312	34	1,682	3,803.8	0	0	0.0	0	0
5 - 10	13.6	6	490	-212,625	26	1,286	7,607.7	0	0	0.0	0	0
10 - 15	20.4	10	836	-318,937	17	825	11,411.5	0	0	0.0	0	0
15 - 20	27.2	7	580	-425,249	10	487	15,215.4	0	0	0.0	0	0
20 - 25	34.0	10	854	-531,561	7	355	19,019.2	0	0	0.0	0	0
25 - 30	40.8	6	486	-637,874	4	175	22,823.1	1	118	0.0	0	0
30 - 35	47.6	8	673	-744,186	3	147	26,626.9	10	8 87	0.0	0	0
35 - 40	54.4	7	585	-850,498	0	10	30,430.8	19	1,697	0.0	0	0
40 - 45	61.2	5	413	-956,811	0	0	34,234.6	14	1,207	0.0	0	0
45 - 50	68.0	6	521	-1,063,123	0	0	38,038.5	15	1,288	0.0	0	0
50 - 55	74.8	6	506	-1,169,435	0	0	41,842.3	12	1,093	0.0	0	0
55 - 60	81.6	4	349	-1,275,748	0	0	45,646.2	9	801	0.0	0	0
60 - 65	88.4	4	330	-1,382,060	0	0	49,450.0	4	392	0.0	0	0
65 - 70	95.2	3	267	-1,488,372	0	0	53,253.9	3	231	0.0	0	0
70 - 75	102.0	3	259	-1,594,685	0	0	57,057.7	3	233	0.0	0	0
75 - 80	108.8	2	147	-1,700,997	0	0	60,861.5	3	232	0.0	0	0
80 - 85	115.6	3	258	-1,807,309	0	0	64,665.4	2	154	0.0	0	0
85 - 90	122.4	1	97	-1,913,622	0	TT 0	68,469.2	2	146	0.0	0	0
90 - 95	129.2	1	90	-2,019,934	0.	0	72,273.1	1	89	0.0	0	0
95 - 100	136.0	6	537	-2,126,246	o o	0	76,076.9	2	192	0.0	0	0
Hours Off	0.0	0	0	0	0	3,793	0.0	0	0	0.0	0	8,760

MAIN SYSTEM COOLING - ALTERNATIVE 1
MODIFIED CONFIGURATION - BUILDING 300

internation of the second

-----PEAK COOLING LOADS -----

							(mailt sys	(Cin)							
						Spac	e						Coil		
		Peak	OA	Rm	Supp.	Space	Space	Space	Peak	0	A Rm	Supp.	Coil	Coil	Coil
		Time	Cond.		Dry	Air	Sens.	Lat.	Time	Cond	. Dry	Dry	Air	Sens.	Lat.
Room		Мо/Нг	DB/WB	Blb	Bulb	Flow	Load	Load	Mo/Hr	DB/W	B Blb	Bulb	Flow	Load	Load
	Description		(F)	(F)	(F)	(Cfm)	(Btuh)	(Btuh)		(F) (F)	(F)	(Cfm)	(Btuh)	(Btuh)
1	Z1-BSMT EAST	7/15	98 64	76	55.0	360	7,243	4,682	7/15	98	64 76	55.0	360	7,508	4,554
Zone	1 Total/Ave	•	98 64	76	55.0	360	7,243	4,682		98	64 76	55.0	360	7,508	4,554
Zone	1 Block	7/15	98 64	76	55.0	360	7,243	4,682	7/15	98	64 76	55.0	360	7,508	4,554
	Z1-1ST FLR EAST		97 64	76	55.0	1,147	23,065	1,676	7/16	97	64 76	55.0	1,247	26,335	1,269
Zone	2 Total/Ave		97 64	76	55.0	1,147	23,065	1,676		97	64 76	55.0	1,247	26,335	1,269
Zone	2 Block		97 64	76	55.0	1,147	23,065	1,676	7/16	97	64 76	55.0	1,247	26,335	1,269
	Z2-1ST FLR EAST	-			55.0	6,858	124,761	1,149	7/16	97	64 74	55.0	7,108	136,197	-1,285
Zone	3 Total/Ave		97 64		55.0	6,858	124,761	1,149		97	64 74	55.0	7,108	136,197	-1,285
Zone	3 Block		97 64		55.0	6,858	124,761	1,149	7/16	97	64 74	55.0	7,108	136,197	-1,285
	Z1-2ND FLR EAST				55.0	1,122	22,551	1,296	7/16	97	64 76	55.0	1,348	27,957	898
Zone	4 Total/Ave		97 64		55.0	1,122	22,551	1,296		97	64 76	55.0	1,348	27,957	898
Zone	4 Block		97 64		55.0	1,122	22,551	1,296	7/16	97	64 76	55.0	1,348	27,957	898
	Z2-2ND FLR EAST	-			55.0	2,890	52,575	1,909		97			3,358	63,070	883
Zone	5 Total/Ave		97 64		55.0	2,890	52,575	1,909		97	64 74	55.0	3,358	63,070	883
Zone	5 Block		97 64		55.0	2,890	52,575	1,909	7/16	97	64 74	55.0	3,358	63,070	883
System	1 Total/Ave	-	97 64		55.0	12,377	230,196	10,712		97	64 74	55.0	13,420	261,066	6,318
System	1 Block	- 7/16	97 64		55.0	12,374	230,153	10,712	7/16	97	64 74	55.0	13,418	265,201	6,318
6	Z1-BSMT WEST	7/15	98 64		55.0	252	5,077	2,680	7/15	98	64 76	55.0	251	5,590	2,643
Zone	6 Total/Ave	-	98 64		55.0		- 5,077	2,680		98	64 76	55.0	251	5,590	2,643
Zone	6 Block		98 64		55.0	252	5,077	2,680	7/15	98	64 76	55.0	251	5,590	2,643
	Z2-BSMT WEST	-	98 64		76.0	0	0	-16	7/15	98	64 76	76.0	0	0	-16
Zone	7 Total/Ave	-	98 64		76.0	0	0	-16		98	64 76	76.0	0	0	-16
Zone	7 Block		98 64		76.0	0	0	-16	7/15	98	64 76	76.0	0	0	-16
	Z1-1ST FLR WEST		97 64		55.0	1,403	28,209	1,427	7/16	97	64 76	55.0	1,597	33,408	1,220
Zone	8 Total/Ave		97 64		55.0	1,403	28,209	1,427			64 76	55.0	1,597	33,408	1,220
Zone	8 Block		97 64		55.0	1,403	28,209	1,427	7/16	97	64 76	55.0	1,597	33,408	1,220
	Z2-1ST FLR WEST	-			55.0	7,189	130,780	606	7/16	97	64 74	55.0	7,367	142,485	-453
Zone	9 Total/Ave		97 64		55.0	7,189	130,780	606		97	64 74	55.0	7,367	142,485	-453
Zone	9 Block	7/16			55.0	7,189	130,780	606	7/16	97	64 74	55.0	7,367	142,485	-453
10	Z1-2ND FLR WEST	-			55.0	1,355	27,237	1,427	7/16	97	64 76	55.0	1,665	34,300	1,228
Zone	10 Total/Ave		97 64		55.0	1,355	27,237	1,427			64 76	55.0	1,665	34,300	1,228
Zone	10 Block		97 64		55.0	1,355	27,237	•	7/16	97	64 76	55.0	1,665	34,300	1,228
	Z2-2ND FLR WEST					10,823	196,903	2,126	7/16		64 74	55.0	11,236	213,448	532
Zone	11 Total/Ave				55.0	10,823	196,903	2,126		97	64 74	55.0	11,236	213,448	532
Zone	11 Block		97 64			10,823	196,903	2,126	7/16	97	64 74	55.0	11,236	213,448	532
System	2 Total/Ave		97 64			21,022	388,205	8,250				55.0	22,117	429,231	5,154
System	2 Block		97 64			20,843	384,909		7/16	97	64 74	55.0	21,939	432,290	5,154
12	Z3-BSMT SOUTH	7/15				171	3,447		7/15		64 76	55.0	170	3,622	2,847
Zone	12 Total/Ave		98 64			171	3,447	2,882				55.0	170	3,622	2,847
Zone	12 Block		98 64			171	3,447		7/15		64 76		170	3,622	2,847
	Z2-BSMT SOUTH		98 64		55.0	9,443	171,787		7/15			55.0	9,304	184,449	-297
Zone	13 Total/Ave		98 64			9,443	171,787	1,629			64 74		9,304	184,449	-297
Zone	13 Block		98 64			9,443	171,787		7/15				9,304	184,449	-297
	Z1-BSMT SOUTH		98 64			1,044	18,994		7/15			55.0	916	18,329	2,753
Zone	14 Total/Ave				55.0	1,044		2,966				55.0	916	18,329	2,753
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Zone	14 Block 7/15	98 64	74	55.0	1,044	18,994	2,966	7/15	98	64 74	55.0	916	18,329	2,753
15	Z1-1ST FLR SOUTH 7/16	97 64	76	55.0	2,654	53,369	5,180	7/16	97	64 76	55.0	2,923	61,795	4,639
7000	15 Total/Ave.	97 64	76	55.0	2.654	53.369	5.180		97	64 76	55.0	2,923	61,795	4,639

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

MAIN SYSTEM COOLING - ALTERNATIVE 1
MODIFIED CONFIGURATION - BUILDING 300

PEAK COOLING LOADS -----(Main System)

					Spac	:e					Coil		
	Peak	OA	Rm	Supp.	Space	Space	Space	Peak	OA R	n Supp.	Coil	Coil	Coil
	Time	Cond.	Dry	Dry	Air	Sens.	Lat.	Time	Cond. Dry	/ Dry	Air	Sens.	Lat.
Room	Mo/Hr	DB/WB	Blb	Bulb	Flow	Load	Load	Mo/Hr	DB/WB B(Bulb	Flow	Load	Load
Number	Description	(F)	(F)	(F)	(Cfm)	(Btuh)	(Btuh)		(F) (F)) (F)	(Cfm)	(Btuh)	(Btuh)
Zone	15 Block 7/16	97 64	76	55.0	2,654	53,369	5,180	7/16	97 64 76	5 55.0	2,923	61,795	4,639
16	Z2-1ST FLR SOUTH 7/12	93 62	76	55.0	5,263	105,825	3,125	7/12	93 62 76	55.0	5,430	114,518	2,052
Zone	16 Total/Ave.	93 62	76	55.0	5,263	105,825	3,125		93 62 76	55.0	5,430	114,518	2,052
Zone	16 Block 7/12	93 62	76	55.0	5,263	105,825	3,125	7/12	93 62 76	55.0	5,430	114,518	2,052
17	Z3-1ST FLR SOUTH 7/16	97 64	74	55.0	2,792	50,794	2,573	7/16	97 64 74	55.0	2,945	57,064	2,004
Zone	17 Total/Ave.	97 64	74	55.0	2,792	50,794	2,573		97 64 74	55.0	2,945	57,064	2,004
Zone	17 Block 7/16	97 64	74	55.0	2,792	50,794	2,573	7/16	97 64 74	55.0	2,945	57,064	2,004
18	Z3-2ND FLR SOUTH 7/16	97 64	74	55.0	10,321	187,763	2,575	7/16	97 64 74	55.0	11,188	212,225	470
Zone	18 Total/Ave.	97 64	74	55.0	10,321	187,763	2,575		97 64 74	55.0	11,188	212,225	470
Zone	18 Block 7/16	97 64	74	55.0	10,321	187,763	2,575	7/16	97 64 74	55.0	11,188	212,225	470
19	Z1-2ND FLR SOUTH 7/16	97 64	76	55.0	1,378	27,716	212	7/16	97 64 76	55.0	1,709	35,382	-69
Zone	19 Total/Ave.	97 64	76	55.0	1,378	27,716	212		97 64 76	55.0	1,709	35,382	-69
Zone	19 Block 7/16	97 64	76	55.0	1,378	27,716	212	7/16	97 64 76	55.0	1,709	35,382	-69
20	Z2-2ND FLR SOUTH 7/16	97 64	74	55.0	10,380	188,845	5,241	7/16	97 64 74	55.0	11,146	212,139	3,124
Zone	20 Total/Ave.	97 64	74	55.0	10,380	188,845	5,241		97 64 74	55.0	11,146	212,139	3,124
Zone	20 Block 7/16	97 64	74	55.0	10,380	188,845	5,241	7/16	97 64 74	55.0	11,146	212,139	3,124
System	3 Total/Ave.	97 64	74	55.0	43,447	808,540	26,384		97 64 74	55.0	45,731	899,523	17,523
System	3 Block 7/16	97 64	74	55.0	42,859	797,607	26,384	7/16	97 64 74	55.0	45,144	905,508	17,523

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BUILDING COOL-HEAT DEMAND - ALTERNATIVE 1 MODIFIED CONFIGURATION - BUILDING 300

July			Desi	an	Weekd	av	Satu	irdav	Sunc	lav		l
Hour	OADB	OAWB	Htg Btuh	-	Htg Btuh		Htg Btuh		Htg Btuh	•	Mond	
1		63.5	0	83.5	0	82.7	0	97.8	nty stun		Htg Btuh	
2		62.1	0	78.8	0	79.1	0	88.0		90.7	0	89.0
3		61.1	o	75.0	0	75.4	0		0	84.5	0	82.9
4		60.2	0	71.3	0	72.2	0	83.1	0	80.0	0	78.5
5		60.9	0	68.4	0			78.9	0	76.2	0	74.7
6		61.6	0	66.1	-	69.1	0	75.2	0	72.8	0	71.3
7		62.1	0	64.5	0	67.4	0	73.4	0	71.1	0	69.5
8		61.8			0	65.8	0	71.4	0	69.3	0	67.6
9		62.6	0	72.2	0	72.2	0	69.0	0	67.2	0	73.8
10		63.8	0	97.8	0	100.2	0	69.1	0	67.4	0	102.5
11		64.4	0	109.0	0	115.9	0	73.1	0	71.3	0	118.6
12		65.8	0	123.4	0	129.3	0	75.1	0	73.6	0	130.8
13		66.9	0	134.8	0	136.0	0	81.0	0	79.3	0	136.0
14			0	136.0	0	136.0	0	85.4	0	83.9	0	136.0
		67.6	0	136.0	0	136.0	0	90.2	0	88.7	0	136.0
15		68.3	0	136.0	0	136.0	0	94.8	0	93.3	0	136.0
16		68.6	0	136.0	0	136.0	0	98.3	0	96.9	0	136.0
17		68.4	0	136.0	0	136.0	0	101.9	0	100.6	0	136.0
18		67.9	0	136.0	0	136.0	0	103.8	. 0	102.6	0	136.0
19		67.8	0	136.0	0	136.0	0	106.1	0	105.0	0	136.0
20		66.7	0	120.1	0	136.0	0	106.0	0	105.0	0	136.0
21		66.7	0	110.4	0	121.2	0	104.1	0	103.2	0	125.2
22		66.5	0	102.0	0	115.0	0	103.8	0	103.0	0	115.0
23	84.3		0	94.5	0	113.2	0	101.1	0	100.5	. 0	113.2
24	81.8	65.0	0	89.5	0	108.8	0	95.8	0	95.2	0	109.7
						İ						
August			B !									
August		OALID	-	gn	Weekda		Satur		Sunda		Mond	
Hour	OADB		Htg Btuh	Clg Ton	Htg Btuh	Clg Ton	Htg Btuh	Clg Ton	Htg Btuh	Clg Ton	Mond Htg Btuh	
Hour 1	0ADB 77.6	62.9	Htg Btuh O	Clg Ton 92.4	Htg Btuh C	Clg Ton 79.1	Htg Btuh O	Clg Ton 90.9				
Hour 1 2	OADB 77.6 75.5	62.9 62.1	Htg Btuh O O	Clg Ton 92.4 78.1	Htg Btuh O O	Clg Ton 79.1 76.7	Htg Btuh O O	Clg Ton 90.9 85.7	Htg Btuh	Clg Ton	Htg Btuh	Clg Ton
Hour 1 2 3	OADB 77.6 75.5 73.8	62.9 62.1 61.5	Htg Btuh O O	Clg Ton 92.4 78.1 72.5	Htg Btuh O O O	Clg Ton 79.1 76.7 72.7	Htg Btuh O	Clg Ton 90.9	Htg Btuh O	Clg Ton 84.4	Htg Btuh O	Clg Ton 82.6
Hour 1 2 3 4	OADB 77.6 75.5 73.8 72.5	62.9 62.1 61.5 61.0	Htg Btuh O O O	Clg Ton 92.4 78.1 72.5 68.5	Htg Btuh O O O	79.1 76.7 72.7 69.5	Htg Btuh O O	Clg Ton 90.9 85.7	Htg Btuh O O	Clg Ton 84.4 79.8	Htg Btuh O O	Clg Ton 82.6 78.2
Hour 1 2 3 4 5	OADB 77.6 75.5 73.8 72.5 71.6	62.9 62.1 61.5 61.0 61.2	Htg Btuh 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1	Htg Btuh O O O O	79.1 76.7 72.7 69.5 66.4	Htg Btuh O O O	Clg Ton 90.9 85.7 80.4	Htg Btuh O O O	Clg Ton 84.4 79.8 75.4	Htg Btuh O O O	Clg Ton 82.6 78.2 73.8
Hour 1 2 3 4 5	OADB 77.6 75.5 73.8 72.5 71.6 71.4	62.9 62.1 61.5 61.0 61.2 61.8	Htg Btuh 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3	Htg Btuh O O O O O	79.1 76.7 72.7 69.5 66.4 63.9	Htg Btuh O O O	Clg Ton 90.9 85.7 80.4 76.1	Htg Btuh O O O	Clg Ton 84.4 79.8 75.4 71.8	Htg Btuh O O O O	Clg Ton 82.6 78.2 73.8 70.2
Hour 1 2 3 4 5 6	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9	62.9 62.1 61.5 61.0 61.2 61.8 62.1	Htg Btuh 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9	Htg Btuh O O O O	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0	Htg Btuh 0 0 0 0 0	Clg Ton 90.9 85.7 80.4 76.1 71.9	Htg Btuh O O O O	Clg Ton 84.4 79.8 75.4 71.8 68.6	Htg Btuh 0 0 0 0 0	Clg Ton 82.6 78.2 73.8 70.2 67.0
Hour 1 2 3 4 5 6 7	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0	Htg Btuh 0 0 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9 68.7	Htg Btuh O O O O O	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0 71.0	Htg Btuh 0 0 0 0 0 0	Clg Ton 90.9 85.7 80.4 76.1 71.9 68.3	Htg Btuh O O O O O	Clg Ton 84.4 79.8 75.4 71.8 68.6 66.1	Htg Btuh 0 0 0 0 0 0	Clg Ton 82.6 78.2 73.8 70.2 67.0 64.4
Hour 1 2 3 4 5 6 7 8	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5 75.9	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0 63.2	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9 68.7 96.2	Htg Btuh 0 0 0 0 0 0 0	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0	Htg Btuh 0 0 0 0 0 0 0	Clg Ton 90.9 85.7 80.4 76.1 71.9 68.3 65.5	Htg Btuh 0 0 0 0 0 0 0	Clg Ton 84.4 79.8 75.4 71.8 68.6 66.1 64.1	Htg Btuh 0 0 0 0 0 0 0	Clg Ton 82.6 78.2 73.8 70.2 67.0 64.4 62.4
Hour 1 2 3 4 5 6 7 8 9	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5 75.9 79.0	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0 63.2 64.2	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9 68.7 96.2	Htg Btuh 0 0 0 0 0 0 0	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0 71.0 98.5 111.7	Htg Btuh 0 0 0 0 0 0 0	Clg Ton 90.9 85.7 80.4 76.1 71.9 68.3 65.5 66.0	Htg Btuh 0 0 0 0 0 0 0	Clg Ton 84.4 79.8 75.4 71.8 68.6 66.1 64.1 64.7	Htg Btuh 0 0 0 0 0 0 0	Clg Ton 82.6 78.2 73.8 70.2 67.0 64.4 62.4 71.4
Hour 1 2 3 4 5 6 7 8 9 10	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5 75.9 79.0 82.4	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0 63.2 64.2 65.0	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9 68.7 96.2	Htg Btuh	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0 71.0 98.5 111.7 126.3	Htg Btuh	Clg Ton 90.9 85.7 80.4 76.1 71.9 68.3 65.5 66.0 65.1	Htg Btuh 0 0 0 0 0 0 0 0	Clg Ton 84.4 79.8 75.4 71.8 68.6 66.1 64.1 64.7 63.8	Htg Btuh 0 0 0 0 0 0 0 0	Clg Ton 82.6 78.2 73.8 70.2 67.0 64.4 62.4 71.4 98.9
Hour 1 2 3 4 5 6 7 8 9 10 11	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5 75.9 79.0 82.4 85.8	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0 63.2 64.2 65.0 66.1	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9 68.7 96.2 109.8 125.3 135.8	Htg Btuh	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0 71.0 98.5 111.7	Htg Btuh	Clg Ton 90.9 85.7 80.4 76.1 71.9 68.3 65.5 66.0 65.1 67.0	Htg Btuh 0 0 0 0 0 0 0 0	Clg Ton 84.4 79.8 75.4 71.8 68.6 66.1 64.1 64.7 63.8 65.7	Htg Btuh 0 0 0 0 0 0 0 0	Clg Ton 82.6 78.2 73.8 70.2 67.0 64.4 62.4 71.4 98.9 112.0 126.5
Hour 1 2 3 4 5 6 7 8 9 10 11 12	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5 75.9 79.0 82.4 85.8 88.9	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0 63.2 64.2 65.0 66.1 67.1	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9 68.7 96.2 109.8 125.3 135.8 136.0	Htg Btuh	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0 71.0 98.5 111.7 126.3 135.8 136.0	Htg Btuh	Clg Ton 90.9 85.7 80.4 76.1 71.9 68.3 65.5 66.0 65.1 67.0 70.4	Htg Btuh	Clg Ton 84.4 79.8 75.4 71.8 68.6 66.1 64.1 64.7 63.8 65.7 69.2	Htg Btuh	Clg Ton 82.6 78.2 73.8 70.2 67.0 64.4 62.4 71.4 98.9 112.0 126.5 135.5
Hour 1 2 3 4 5 6 7 8 9 10 11 12 13 14	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5 75.9 79.0 82.4 85.8 88.9 91.3	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0 63.2 64.2 65.0 66.1 67.1 67.7	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9 68.7 96.2 109.8 125.3 135.8 136.0	Htg Btuh	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0 71.0 98.5 111.7 126.3 135.8	Htg Btuh	Clg Ton 90.9 85.7 80.4 76.1 71.9 68.3 65.5 66.0 65.1 67.0 70.4 74.7	Htg Btuh	Clg Ton 84.4 79.8 75.4 71.8 68.6 66.1 64.1 64.7 63.8 65.7 69.2 73.4	Htg Btuh	Clg Ton 82.6 78.2 73.8 70.2 67.0 64.4 62.4 71.4 98.9 112.0 126.5 135.5
Hour 1 2 3 4 5 6 7 8 9 10 11 12 13 14	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5 75.9 79.0 82.4 85.8 88.9 91.3 92.9	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0 63.2 64.2 65.0 66.1 67.1 67.7 67.5	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9 68.7 96.2 109.8 125.3 135.8 136.0 136.0	Htg Btuh	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0 71.0 98.5 111.7 126.3 135.8 136.0	Htg Btuh	Clg Ton 90.9 85.7 80.4 76.1 71.9 68.3 65.5 66.0 65.1 67.0 70.4 74.7 80.9	Htg Btuh	Clg Ton 84.4 79.8 75.4 71.8 68.6 66.1 64.1 64.7 63.8 65.7 69.2 73.4 79.5	Htg Btuh	Clg Ton 82.6 78.2 73.8 70.2 67.0 64.4 62.4 71.4 98.9 112.0 126.5 135.5 136.0
Hour 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5 75.9 79.0 82.4 85.8 88.9 91.3 92.9 93.4	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0 63.2 64.2 65.0 66.1 67.7 67.5 67.4	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9 68.7 96.2 109.8 125.3 135.8 136.0	Htg Btuh	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0 71.0 98.5 111.7 126.3 135.8 136.0 136.0	Htg Btuh	Clg Ton 90.9 85.7 80.4 76.1 71.9 68.3 65.5 66.0 65.1 67.0 70.4 74.7 80.9 85.1	Htg Btuh	Clg Ton 84.4 79.8 75.4 71.8 68.6 66.1 64.1 64.7 63.8 65.7 69.2 73.4 79.5 83.7 88.1	Htg Btuh	Clg Ton 82.6 78.2 73.8 70.2 67.0 64.4 62.4 71.4 98.9 112.0 126.5 135.5 136.0 136.0
Hour 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5 75.9 79.0 82.4 85.8 88.9 91.3 92.9 93.4 93.1	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0 63.2 64.2 65.0 66.1 67.7 67.5 67.4 67.0	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9 68.7 96.2 109.8 125.3 135.8 136.0 136.0	Htg Btuh	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0 71.0 98.5 111.7 126.3 135.8 136.0 136.0	Htg Btuh	Clg Ton 90.9 85.7 80.4 76.1 71.9 68.3 65.5 66.0 65.1 67.0 70.4 74.7 80.9 85.1 89.4	Htg Btuh	Clg Ton 84.4 79.8 75.4 71.8 68.6 66.1 64.1 64.7 63.8 65.7 69.2 73.4 79.5 83.7 88.1 92.2	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 82.6 78.2 73.8 70.2 67.0 64.4 62.4 71.4 98.9 112.0 126.5 135.5 136.0 136.0 136.0
Hour 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5 75.9 79.0 82.4 85.8 88.9 91.3 92.9 93.4 93.1 92.3	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0 63.2 64.2 65.0 66.1 67.7 67.5 67.4 67.0 66.7	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9 68.7 96.2 109.8 125.3 135.8 136.0 136.0 136.0	Htg Btuh	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0 71.0 98.5 111.7 126.3 135.8 136.0 136.0 136.0	Htg Btuh	Clg Ton 90.9 85.7 80.4 76.1 71.9 68.3 65.5 66.0 65.1 67.0 70.4 74.7 80.9 85.1 89.4 93.4	Htg Btuh	Clg Ton 84.4 79.8 75.4 71.8 68.6 66.1 64.1 64.7 63.8 65.7 69.2 73.4 79.5 83.7 88.1 92.2 95.3	Htg Btuh	Clg Ton 82.6 78.2 73.8 70.2 67.0 64.4 62.4 71.4 98.9 112.0 126.5 135.5 136.0 136.0 136.0 136.0
Hour 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5 75.9 79.0 82.4 85.8 88.9 91.3 92.9 93.4 93.1 92.3 91.0	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0 63.2 64.2 65.0 66.1 67.7 67.5 67.4 67.0 66.7	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9 68.7 96.2 109.8 125.3 135.8 136.0 136.0 136.0	Htg Btuh	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0 71.0 98.5 111.7 126.3 135.8 136.0 136.0 136.0 136.0	Htg Btuh	Clg Ton 90.9 85.7 80.4 76.1 71.9 68.3 65.5 66.0 65.1 67.0 70.4 74.7 80.9 85.1 89.4 93.4	Htg Btuh	Clg Ton 84.4 79.8 75.4 71.8 68.6 66.1 64.1 64.7 63.8 65.7 69.2 73.4 79.5 83.7 88.1 92.2	Htg Btuh	Clg Ton 82.6 78.2 73.8 70.2 67.0 64.4 62.4 71.4 98.9 112.0 126.5 135.5 136.0 136.0 136.0 136.0 136.0
Hour 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5 75.9 79.0 82.4 85.8 88.9 91.3 92.9 93.4 93.1 92.3 91.0 89.2	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0 63.2 64.2 65.0 66.1 67.7 67.5 67.4 67.0 66.7 66.7	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9 68.7 96.2 109.8 125.3 135.8 136.0 136.0 136.0 136.0	Htg Btuh	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0 71.0 98.5 111.7 126.3 135.8 136.0 136.0 136.0 136.0 136.0	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 90.9 85.7 80.4 76.1 71.9 68.3 65.5 66.0 65.1 67.0 70.4 74.7 80.9 85.1 89.4 93.4 96.5 97.6	Htg Btuh	Clg Ton 84.4 79.8 75.4 71.8 68.6 66.1 64.1 64.7 63.8 65.7 69.2 73.4 79.5 83.7 88.1 92.2 95.3 96.6	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 82.6 78.2 73.8 70.2 67.0 64.4 62.4 71.4 98.9 112.0 126.5 135.5 136.0 136.0 136.0 136.0 136.0
Hour 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5 75.9 79.0 82.4 85.8 88.9 91.3 92.9 93.4 93.1 92.3 91.0 89.2 87.2	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0 63.2 64.2 65.0 66.1 67.7 67.5 67.4 67.0 66.7 66.7 66.5	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9 68.7 96.2 109.8 125.3 135.8 136.0 136.0 136.0 136.0 136.0	Htg Btuh	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0 71.0 98.5 111.7 126.3 135.8 136.0 136.0 136.0 136.0 136.0 136.0 136.0	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 90.9 85.7 80.4 76.1 71.9 68.3 65.5 66.0 65.1 67.0 70.4 74.7 80.9 85.1 89.4 93.4 96.5 97.6 99.7	Htg Btuh	Clg Ton 84.4 79.8 75.4 71.8 68.6 66.1 64.1 64.7 63.8 65.7 69.2 73.4 79.5 83.7 88.1 92.2 95.3 96.6 98.7	Htg Btuh	Clg Ton 82.6 78.2 73.8 70.2 67.0 64.4 62.4 71.4 98.9 112.0 126.5 135.5 136.0 136.0 136.0 136.0 136.0
Hour 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5 75.9 79.0 82.4 85.8 88.9 91.3 92.9 93.4 93.1 92.3 91.0 89.2 87.2 84.8	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0 63.2 64.2 65.0 66.1 67.7 67.5 67.4 67.0 66.7 66.7 66.5 66.5	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9 68.7 96.2 109.8 125.3 135.8 136.0 136.0 136.0 136.0 136.0 136.0	Htg Btuh	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0 71.0 98.5 111.7 126.3 135.8 136.0 136.0 136.0 136.0 136.0 136.0 136.0 136.0	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 90.9 85.7 80.4 76.1 71.9 68.3 65.5 66.0 65.1 67.0 70.4 74.7 80.9 85.1 89.4 93.4 96.5 97.6 99.7	Htg Btuh	Clg Ton 84.4 79.8 75.4 71.8 68.6 66.1 64.1 64.7 63.8 65.7 69.2 73.4 79.5 83.7 88.1 92.2 95.3 96.6 98.7 99.5	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 82.6 78.2 73.8 70.2 67.0 64.4 62.4 71.4 98.9 112.0 126.5 135.5 136.0 136.0 136.0 136.0 136.0 136.0
Hour 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5 75.9 79.0 82.4 85.8 88.9 91.3 92.9 93.4 93.1 92.3 91.0 89.2 87.2	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0 63.2 64.2 65.0 66.1 67.7 67.5 67.4 67.0 66.7 66.7 66.5 66.5	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9 68.7 96.2 109.8 125.3 135.8 136.0 1	Htg Btuh	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0 71.0 98.5 111.7 126.3 135.8 136.0 136.0 136.0 136.0 136.0 136.0 136.0 136.0 136.0 136.0	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 90.9 85.7 80.4 76.1 71.9 68.3 65.5 66.0 65.1 67.0 70.4 74.7 80.9 85.1 89.4 93.4 96.5 97.6 99.7 100.5 99.4 97.9	Htg Btuh	Clg Ton 84.4 79.8 75.4 71.8 68.6 66.1 64.1 64.7 63.8 65.7 69.2 73.4 79.5 83.7 88.1 92.2 95.3 96.6 98.7 99.5 98.5 97.1	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 82.6 78.2 73.8 70.2 67.0 64.4 62.4 71.4 98.9 112.0 126.5 135.5 136.0 136.0 136.0 136.0 136.0 136.0
Hour 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	OADB 77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5 75.9 79.0 82.4 85.8 88.9 91.3 92.9 93.4 93.1 92.3 91.0 89.2 87.2 84.8	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0 63.2 64.2 65.0 66.1 67.7 67.5 67.4 67.0 66.7 66.7 66.5 66.5 66.3	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 92.4 78.1 72.5 68.5 65.1 62.3 60.9 68.7 96.2 109.8 125.3 135.8 136.0 136.0 136.0 136.0 136.0 136.0 136.0 136.0 136.0 130.0 1	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 79.1 76.7 72.7 69.5 66.4 63.9 62.0 71.0 98.5 111.7 126.3 135.8 136.0 136.0 136.0 136.0 136.0 136.0 136.0 136.0 136.0 136.0 136.0	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 90.9 85.7 80.4 76.1 71.9 68.3 65.5 66.0 65.1 67.0 70.4 74.7 80.9 85.1 89.4 93.4 96.5 97.6 99.7	Htg Btuh	Clg Ton 84.4 79.8 75.4 71.8 68.6 66.1 64.1 64.7 63.8 65.7 69.2 73.4 79.5 83.7 88.1 92.2 95.3 96.6 98.7 99.5	Htg Btuh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Clg Ton 82.6 78.2 73.8 70.2 67.0 64.4 62.4 71.4 98.9 112.0 126.5 135.5 136.0 136.0 136.0 136.0 136.0 136.0

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---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

January

17 52.9 37.7

أأنها ويختله والتهار أربون

Design	Cooling	Chiller	Chiller	Storage
DB CAWB	Load	Load	Demand	Capacity
F) (F)	(Ton)	(Ton)	(kW)	(Ton-Hr)
.8 22.9	0.0	0.0	0.0	1,000
.5 21.9	3.6	3.6	2.8	1,000
.4 20.9	5.1	5.1	3.9	1,000
.6 20.4	4.6	4.6	3.5	1,000
.4 20.0	4.1	4.1	3.1	1,000
.9 20.7	3.8	3.8	2.9	1,000
.2 22.0	3.6	3.6	2.8	1,000
3.6 24.0	5.4	5.4	4.1	1,000
7.0 26.5	18.7	0.0	0.0	9 81
0.9 28.5	24.4	0.0	0.0	9 57
5.4 3 0.7	30.8	0.0	0.0	9 26
7.6 34.1	37.2	0.0	0.0	889
2.7 36.1	41.1	0.0	0.0	848
4.8 36.7	44.8	6.0	0.0	803
5.6 37.2	48.5	0.0	0.0	7 55
4.8 36.8	51.7	0.0	0.0	703
3.0 35.6	40.6	0.0	0.0	662
0.1 34.0	33.8	0.0	0.0	629
6.7 31.7	29.2	0.0	0.0	599
3.3 29.9	23.4	300.0	219.0	876
0.4 28.1	20.0			1,000
7.8 26.4	17.3	17.3		1,000
5.7 24.9	14.4			1,000
4.1 23.9	11.3	11.3	8.6	1,000
	DB OAMB F) (F) 2.8 22.9 1.5 21.9 1.4 20.9 2.6 20.4 2.9 20.7 1.2 22.0 3.6 24.0 7.0 26.5 2.9 28.5 5.4 30.7 2.6 34.1 2.7 36.1 4.8 36.8 3.0 35.6 0.1 34.0 6.7 31.7 3.3 29.9 0.4 28.1 7.8 26.4 5.7 24.5	DB OAWB Load (F) (F) (Ton) 2.8 22.9 0.0 (.5 21.9 3.6 (.4 20.9 5.1 (.6 20.4 4.6 (.4 20.0 4.1 (.9 20.7 3.8 (.2 22.0 3.6 (.6 24.0 5.4 (.0 26.5 18.7 (.0 26.5 18.7 (.0 26.5 18.7 (.0 26.5 18.7 (.0 26.5 18.7 (.0 26.5 18.7 (.0 36.1 41.1 (.4 30.7 30.8 (.6 34.1 37.2 (.7 36.1 41.1 (.8 36.7 44.8 (.6 37.2 48.5 (.6 37.2 48.5 (.6 37.2 48.5 (.6 37.2 48.5 (.6 37.2 48.5 (.6 37.2 48.5 (.6 37.2 48.5 (.6 37.2 48.5 (.6 37.2 48.5 (.6 37.2 48.5 (.6 37.2 48.5 (.6 37.2 48.5 (.6 37.2 48.5 (.6 37.2 48.5 (.7 31.7 29.2 (.7 36.1 20.0 (.7 31.7 20.0 (.7 31.7 2	DB OAWB Load Load (F) (F) (Ton) (Ton) 2.8 22.9 0.0 0.0 1.5 21.9 3.6 3.6 1.4 20.9 5.1 5.1 1.6 20.4 4.6 4.6 1.4 20.0 4.1 4.1 1.9 20.7 3.8 3.8 1.2 22.0 3.6 3.6 1.6 24.0 5.4 5.4 1.0 26.5 18.7 0.0 1.9 28.5 24.4 0.0 1.9 28.5 24.4 0.0 1.9 28.5 24.4 0.0 1.9 28.5 24.4 0.0 1.9 28.5 24.4 0.0 1.0 26.5 18.7 0.0 1.1 30.7 30.8 0.0 1.2 20.7 30.8 0.0 1.3 20.9 28.5 24.4 0.0 1.4 30.7 30.8 0.0 1.5 30.7 30.8 0.0 1.6 34.1 37.2 0.0 1.7 36.1 41.1 0.0 1.8 36.7 44.8 0.0 1.8 36.8 51.7 0.0 1.8 36.8 51.	DB OAWB Load Load Demand (F) (F) (Ton) (Ton) (KW) 2.8 22.9 0.0 0.0 0.0 3.5 21.9 3.6 3.6 2.8 3.4 20.9 5.1 5.1 3.9 3.6 20.4 4.6 4.6 3.5 3.4 20.0 4.1 4.1 3.1 3.9 20.7 3.8 3.8 2.9 3.6 24.0 5.4 5.4 4.1 7.0 26.5 18.7 0.0 0.0 3.9 28.5 24.4 0.0 0.0 3.4 30.7 30.8 0.0 0.0 3.6 34.1 37.2 0.0 0.0 3.7 36.1 41.1 0.0 0.0 3.8 36.7 44.8 0.0 0.0 3.8 36.7 44.8 0.0 0.0 3.8 36.8 51.7 0.0 0.0 4.8 36.8 51.7 0.0 0.0 4.8 36.8 51.7 0.0 0.0 5.6 37.2 48.5 0.0 0.0 6.7 31.7 29.2 0.0 0.0 6.7 31.7 29.2 0.0 0.0 6.7 31.7 29.2 0.0 0.0 6.7 31.7 29.2 0.0 0.0 6.7 31.7 29.2 0.0 0.0 6.7 31.7 29.2 0.0 0.0 6.7 31.7 29.2 0.0 0.0 6.7 31.7 29.2 0.0 0.0 6.7 31.7 29.2 0.0 0.0 6.7 31.7 29.2 0.0 0.0 6.7 31.7 29.2 0.0 0.0 6.7 31.7 29.2 0.0 0.0 6.7 31.7 29.2 0.0 0.0 6.7 31.7 39.2 0.0 144.0 114.6 7.8 26.4 17.3 17.3 13.1 5.7 24.9 14.4 14.4

									•	
				We	ekday			Sa	turday	
	Tyt	oical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	OADB	OAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	36.9	28.0	10.6	10.6	8.1	1,000	10.7	10.7	8.2	1,000
2	34.1	25.7	8.2	8.2	6.2	1,000	8.2	8.2	6.3	1,000
3	31.6	23.5	6.3	6.3	4.8	1,000	6.6	6.6	5.0	1,000
4	29.5	21.9	4.9	4.9	3.7	1,000	4.9	4.9	3.8	1,000
5	28.0	20.5	4.3	4.3	3.3	1,000	4.4	4.4	3.4	1,000
6	27.0	20.1	3.9	3.9	3.0	1,000	4.0	4.0	3.1	1,000
7	26.7	20.4	3.6	3.6	2.8	1,000	3.7	3.7	2.8	1,000
8	27.3	21.4	4.4	4:4	3.4	1,000	3.3	3.3	2.5	1,000
9	29.2	23.1	16.3	0.0	0.0	984	3.4	0.0	0.0	997
10	32.1	24.4	20.8	0.0	0.0	963	3.6	0.0	0.0	993
11	35.8	26.3	25.9	0.0	0.0	937	3.7	0.0	0.0	989
12	39.8	28.8	31.2	0.0	0.0	906	4.2	0.0	0.0	985
13	43.9	31.5	34.2	0.0	0.0	872	6.6	0.0	0.0	978
14	47.5	33.8	37.7	0.0	0.0	834	9.5	0.0	0.0	969
						D14-18	8			
15	50.4	35.9	41.1	0.0	0.0	793	12.3	0.0	0.0	957
16	52.3	37.3			0.0	748	14.7	0.0	0.0	942

0.0

33.9

0.0

715

16.7

0.0

0.0

925

40

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

April

Design Cooling Chiller Chiller Storage OADB DAWB Load Load Demand Capacity	
OADB OAWB Load Load Demand Capacity	
Hour (F) (F) (Ton) (Ton) (kW) (Ton-Hr)	
1 58.1 38.1 38.3 38.3 27.6 1,000	
2 56.8 37.7 35.5 35.5 25.8 1,000	
3 55.8 37.2 33.4 33.4 24.5 1,000	
4 55.1 36.9 31.4 31.4 23.2 1,000	
5 54.8 37.0 29.8 29.8 22.1 1,000	
6 55.3 37.6 28.8 28.8 21.5 1,000	
7 56.6 39.2 28.5 28.5 21.3 1,000	
8 58.8 40.0 33.0 33.0 24.2 1,000	
9 62.1 41.3 48.3 0.0 0.0 952	
10 65.8 42.9 55.0 0.0 0.0 897	
11 70.1 45.3 63.0 0.0 0.0 834	
12 74.1 47.5 71.5 0.0 0.0 762	
13 77.1 49.2 82.7 0.0 0.0 679	
14 79.1 50.3 90.1 0.0 0.0 589	
15 79.8 50.5 95.8 0.0 0.0 493	
16 79.1 49.5 103.0 0.0 0.0 390	
17 77.3 48.5 87.2 0.0 0.0 303	
18 74.6 46.8 76.9 0.0 0.0 226	
19 71.3 45.2 70.0 0.0 0.0 156	
20 68.1 44.0 62.2 300.0 221.7 394	
21 65.3 42.6 57.6 300.0 221.7 637	
22 62.8 41.2 53.9 300.0 222.0 883	
23 60.8 40.2 49.1 166.4 126.5 1,000	
24 59.3 39.1 45.3 45.3 32.1 1,000	
Weekday	Saturday
Typical Cooling Chiller Chiller Storage	Cooling Chiller Chiller Storage
OADB OAWB Load Load Demand Capacity	Load Load Demand Capacity
Hour (F) (F) (Ton) (Ton) (kW) (Ton-Hr)	(Ton) (Ton) (kW) (Ton-Hr)
1 60.6 41.7 39.2 39.2 28.2 1,000	39.6 39.6 28.4 1,000
2 58.2 40.7 36.7 36.7 26.5 1,000	37.0 37.0 26.7 1,000
3 56.1 39.5 34.4 34.4 25.1 1,000	34.7 34.7 25.3 1,000
4 54.4 38.6 32.5 32.5 23.9 1,000	32.9 32.9 24.1 1,000
5 53.1 38.1 30.5 30.5 22.6 1,000	30.9 30.9 22.8 1,000
5 53.1 38.1 30.5 30.5 22.6 1,000 6 52.3 38.1 28.9 28.9 21.6 1,000	30.9 30.9 22.8 1,000 29.4 29.4 21.8 1,000
5 53.1 38.1 30.5 30.5 22.6 1,000 6 52.3 38.1 28.9 28.9 21.6 1,000 7 52.0 39.1 27.6 27.6 20.7 1,000	30.9 30.9 22.8 1,000 29.4 29.4 21.8 1,000 28.0 28.0 21.0 1,000
5 53.1 38.1 30.5 30.5 22.6 1,000 6 52.3 38.1 28.9 28.9 21.6 1,000 7 52.0 39.1 27.6 27.6 20.7 1,000 8 52.8 38.7 31.2 31.2 23.0 1,000	30.9 30.9 22.8 1,000 29.4 29.4 21.8 1,000 28.0 28.0 21.0 1,000 27.2 27.2 20.4 1,000
5 53.1 38.1 30.5 30.5 22.6 1,000 6 52.3 38.1 28.9 28.9 21.6 1,000 7 52.0 39.1 27.6 27.6 20.7 1,000 8 52.8 38.7 31.2 31.2 23.0 1,000 9 54.9 39.2 46.0 0.0 0.0 954	30.9 30.9 22.8 1,000 29.4 29.4 21.8 1,000 28.0 28.0 21.0 1,000 27.2 27.2 20.4 1,000 27.2 0.0 0.0 973
5 53.1 38.1 30.5 30.5 22.6 1,000 6 52.3 38.1 28.9 28.9 21.6 1,000 7 52.0 39.1 27.6 27.6 20.7 1,000 8 52.8 38.7 31.2 31.2 23.0 1,000 9 54.9 39.2 46.0 0.0 0.0 954 10 58.2 40.5 51.9 0.0 0.0 902	30.9 30.9 22.8 1,000 29.4 29.4 21.8 1,000 28.0 28.0 21.0 1,000 27.2 27.2 20.4 1,000 27.2 0.0 0.0 973 28.0 0.0 0.0 945
5 53.1 38.1 30.5 30.5 22.6 1,000 6 52.3 38.1 28.9 28.9 21.6 1,000 7 52.0 39.1 27.6 27.6 20.7 1,000 8 52.8 38.7 31.2 31.2 23.0 1,000 9 54.9 39.2 46.0 0.0 0.0 954 10 58.2 40.5 51.9 0.0 0.0 902 11 62.3 43.0 58.7 0.0 0.0 843	30.9 30.9 22.8 1,000 29.4 29.4 21.8 1,000 28.0 28.0 21.0 1,000 27.2 27.2 20.4 1,000 27.2 0.0 0.0 973 28.0 0.0 0.0 945 29.7 0.0 0.0 915
5 53.1 38.1 30.5 30.5 22.6 1,000 6 52.3 38.1 28.9 28.9 21.6 1,000 7 52.0 39.1 27.6 27.6 20.7 1,000 8 52.8 38.7 31.2 31.2 23.0 1,000 9 54.9 39.2 46.0 0.0 0.0 954 10 58.2 40.5 51.9 0.0 0.0 902 11 62.3 43.0 58.7 0.0 0.0 843 12 66.7 45.8 66.5 0.0 0.0 777	30.9 30.9 22.8 1,000 29.4 29.4 21.8 1,000 28.0 28.0 21.0 1,000 27.2 27.2 20.4 1,000 27.2 0.0 0.0 973 28.0 0.0 0.0 945 29.7 0.0 0.0 915 32.2 0.0 0.0 883
5 53.1 38.1 30.5 30.5 22.6 1,000 6 52.3 38.1 28.9 28.9 21.6 1,000 7 52.0 39.1 27.6 27.6 20.7 1,000 8 52.8 38.7 31.2 31.2 23.0 1,000 9 54.9 39.2 46.0 0.0 0.0 954 10 58.2 40.5 51.9 0.0 0.0 902 11 62.3 43.0 58.7 0.0 0.0 777 13 70.7 48.3 73.7 0.0 0.0 703	30.9 30.9 22.8 1,000 29.4 29.4 21.8 1,000 28.0 28.0 21.0 1,000 27.2 27.2 20.4 1,000 27.2 0.0 0.0 973 28.0 0.0 0.0 945 29.7 0.0 0.0 915 32.2 0.0 0.0 883 34.9 0.0 0.0 848
5 53.1 38.1 30.5 30.5 22.6 1,000 6 52.3 38.1 28.9 28.9 21.6 1,000 7 52.0 39.1 27.6 27.6 20.7 1,000 8 52.8 38.7 31.2 31.2 23.0 1,000 9 54.9 39.2 46.0 0.0 0.0 954 10 58.2 40.5 51.9 0.0 0.0 902 11 62.3 43.0 58.7 0.0 0.0 843 12 66.7 45.8 66.5 0.0 0.0 777	30.9 30.9 22.8 1,000 29.4 29.4 21.8 1,000 28.0 28.0 21.0 1,000 27.2 27.2 20.4 1,000 27.2 0.0 0.0 973 28.0 0.0 0.0 945 29.7 0.0 0.0 915 32.2 0.0 0.0 883
5 53.1 38.1 30.5 30.5 22.6 1,000 6 52.3 38.1 28.9 28.9 21.6 1,000 7 52.0 39.1 27.6 27.6 20.7 1,000 8 52.8 38.7 31.2 31.2 23.0 1,000 9 54.9 39.2 46.0 0.0 0.0 954 10 58.2 40.5 51.9 0.0 0.0 902 11 62.3 43.0 58.7 0.0 0.0 777 13 70.7 48.3 73.7 0.0 0.0 703	30.9 30.9 22.8 1,000 29.4 29.4 21.8 1,000 28.0 28.0 21.0 1,000 27.2 27.2 20.4 1,000 27.2 0.0 0.0 973 28.0 0.0 0.0 945 29.7 0.0 0.0 915 32.2 0.0 0.0 883 34.9 0.0 0.0 844 37.8 0.0 0.0 810
5 53.1 38.1 30.5 30.5 22.6 1,000 6 52.3 38.1 28.9 28.9 21.6 1,000 7 52.0 39.1 27.6 27.6 20.7 1,000 8 52.8 38.7 31.2 23.0 1,000 9 54.9 39.2 46.0 0.0 0.0 954 10 58.2 40.5 51.9 0.0 0.0 902 11 62.3 43.0 58.7 0.0 0.0 843 12 66.7 45.8 66.5 0.0 0.0 777 13 70.7 48.3 73.7 0.0 0.0 621 D14-1	30.9 30.9 22.8 1,000 29.4 29.4 21.8 1,000 28.0 28.0 21.0 1,000 27.2 27.2 20.4 1,000 27.2 0.0 0.0 973 28.0 0.0 0.0 945 29.7 0.0 0.0 915 32.2 0.0 0.0 883 34.9 0.0 0.0 884 37.8 0.0 0.0 810
5 53.1 38.1 30.5 30.5 22.6 1,000 6 52.3 38.1 28.9 28.9 21.6 1,000 7 52.0 39.1 27.6 27.6 20.7 1,000 8 52.8 38.7 31.2 31.2 23.0 1,000 9 54.9 39.2 46.0 0.0 0.0 954 10 58.2 40.5 51.9 0.0 0.0 902 11 62.3 43.0 58.7 0.0 0.0 843 12 66.7 45.8 66.5 0.0 0.0 777 13 70.7 48.3 73.7 0.0 0.0 621 D14-1 15 76.2 51.5 87.4 0.0 0.0 0.0 534	30.9 30.9 22.8 1,000 29.4 29.4 21.8 1,000 28.0 28.0 21.0 1,000 27.2 27.2 20.4 1,000 27.2 0.0 0.0 973 28.0 0.0 0.0 945 29.7 0.0 0.0 915 32.2 0.0 0.0 883 34.9 0.0 0.0 884 37.8 0.0 0.0 840
5 53.1 38.1 30.5 30.5 22.6 1,000 6 52.3 38.1 28.9 28.9 21.6 1,000 7 52.0 39.1 27.6 27.6 20.7 1,000 8 52.8 38.7 31.2 31.2 23.0 1,000 9 54.9 39.2 46.0 0.0 0.0 0.0 954 10 58.2 40.5 51.9 0.0 0.0 902 11 62.3 43.0 58.7 0.0 0.0 843 12 66.7 45.8 66.5 0.0 0.0 707 13 70.7 48.3 73.7 0.0 0.0 621 D14-1	30.9 30.9 22.8 1,000 29.4 29.4 21.8 1,000 28.0 28.0 21.0 1,000 27.2 27.2 20.4 1,000 27.2 0.0 0.0 973 28.0 0.0 0.0 945 29.7 0.0 0.0 915 32.2 0.0 0.0 883 34.9 0.0 0.0 884 37.8 0.0 0.0 881

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

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	Tvi	pical				Storage	Cooling	Chiller	Chiller	Storage
	OADB	OAWB	Load	Load	Demand		Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
18	52.6	37.9	27.9	0.0	0.0	687	18.0	0.0	0.0	907
19	51.6	38.7	24.8	0.0	0.0	662	19.1	0.0	0.0	888
20	50.1	38.3	20.7	300.0	219.0	941	19.3	131.1	108.5	1,000
21	48.0	37.0	18.7	77.5	58.8	1,000	18.5	18.5	14.1	1,000
22	45.5	35.2	17.1	17.1	13.0	1,000	17.0	17.0	12.9	1,000
23	42.7	32.9	14.6	14.6	11.1	1,000	14.7	14.7	11.2	1,000
24	39.8	30.3	12.5	12.5	9.5	1,000	12.6	12.6	9.6	1,000
				_					landase	
			••••••						-	
	Ty	pical	Cooling			Storage		Chiller		Storage
	OADB	OAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	36.9	28.0	10.5	10.5	8.0	1,000	10.1	10.1	7.7	1,000
2	34.1	25.7	8.0	8.0	6.1	1,000	7.6	7.6	5.8	1,000
3	31.6	23.5	6.4	6.4	4.9	1,000	6.0	6.0	4.6	1,000
4	29.5	21.9	4.9	4.9	3.7	1,000	4.8	4.8	3.6	1,000
5	28.0	20.5	4.3	4.3	3.3	1,000	4.2	4.2	3.2	1,000
6	27.0	20.1	4.0	4.0	3.0	1,000	3.9	3.9	2.9	1,000
7	26.7	20.4	3.7	3.7	2.8	1,000	3.6	3.6	2.7	1,000
8	27.3	21.4	3.3	3.3	2.5	1,000	4.3	4.3	3.3	1,000
9	29.2	23.1	3.4	0.0	0.0	997	7 16.2	0.0	0.0	984
10	32.1	24.4	3.5	0.0	0.0	993	20.8	0.0	0.0	963
11	35.8	26.3	3.7	0.0	0.0	989	25.9	0.0	0.0	937
12	39.8	28.8	4.2	0.0	0.0	985	31.2	0.0	0.0	906
13	43.9	31.5	6.6	0.0	0.0	979	34.2	0.0	0.0	872
14	47.5	33.8	9.5	0.0	0.0	969	37.7	0.0	0.0	834
15	50.4	35.9	12.2	0.0	0.0	957	41.1	0.0	0.0	793
16	52.3	37.3	14.7	0.0	0.0	942	44.2	0.0	0.0	749
17	52.9	37.7	16.6	0.0	0.0	926	33.9	0.0	0.0	715
18	52.6	37.9	18.0	0.0	0.0	908	27.9	0.0	0.0	687
19	51.6	38.7	19.1	0.0	0.0	888	24.8	0.0	0.0	662
20	50.1	38.3	19.3	130.9	108.3	1,000	20.7	300.0	219.0	941
21	48.0	37.0	18.5	18.5	14.1	1,000	18.7	77.4	58.7	1,000
22	45.5	35.2	17.0	17.0	12.9	1,000	17.1	17.1	13.0	1,000
23	42.7	32.9	14.7	14.7	11.2	1,000	14.6	14.6	11.1	1,000
										4 000

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				11-				Sa	iturday	
	T	-:1				Ctonomo		Chiller	•	Storage
		pical	-	Chiller		Storage	-	Load	Demand	Capacity
	OADB	OAWB	Load	Load	Demand	Capacity	Load		(kW)	(Ton-Hr)
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(KW)	(TOIL-NIT)
18	75.9	49.8	63.5	0.0	0.0	306	45.2	0.0	0.0	638
19	74.6	49.3	57.2	0.0	0.0	248	45.8	0.0	0.0	592
20	72.8	49.4	50.4	300.0	224.3	498	45.7	300.0	224.3	847
21	70.7	48.5	48.2	300.0	223.6	750	45.4	198.7	146.7	1,000
22	68.3	47.1	46.6	296.8	220.0	1,000	44.1	44.1	31.3	1,000
23	65.8	45.8	44.3	44.3	31.5	1,000	42.3	42.3	30.1	1,000
24	63.2	43.8	41.6	41.6	29.7	1,000	40.2	40.2	28.8	1,000
					•				londay	
	• • •	pical	-	Chiller		Storage		Chiller		Storage
	OADB	OAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
	(0.(/4 7	77.0	77.0	27 /	1,000	77.0	37.2	26.9	1,000
1	60.6	41.7	37.9	37.9	27.4	=	37.2		25.4	1,000
2	58.2	40.7	35.7	35.7	25.9	1,000 1,000	34.9 32.8	34.9 32.8	24.1	1,000
3	56.1	39.5	33.6	33.6	24.5	•				1,000
4	54.4	38.6	31.8	31.8	23.4	1,000	31.1	31.1	22.9 21.8	1,000
5	53.1	38.1	30.0	30.0	22.2	1,000	29.2	29.2	20.8	1,000
6	52.3	38.1	28.5	28.5	21.3	1,000	27.8	27.8	20.0	1,000
7	52.0	39.1	27.3	27.3	20.5	1,000	26.5	26.5		-
8	52.8	38.7	26.5	26.5	20.0	1,000	30.2	30.2 0.0	22.4 0.0	1,000 955
9	54.9	39.2	26.6	0.0	0.0	973 —	44.7	0.0		905
10	58.2	40.5	27.5	0.0	0.0	946 917	50.5 57.4	0.0	0.0 0.0	903 847
11 12	62.3 66.7	43.0 45.8	29.2 31.8	0.0 0.0	0.0 0.0	885	64.2	0.0	0.0	783
13	70.7	48.3	34.4	0.0	0.0	851	67.9	0.0	0.0	715
14	74.1	50.5	37.4	0.0	0.0	813	74.5	0.0	0.0	641
15	76.2	51.5	39.9	0.0	0.0	773	83.4	0.0	0.0	557
16	77.0	51.0	42.0	0.0	0.0	773 731	87.8	0.0	0.0	470
17	76.7	50.7	43.6	0.0	0.0	688	72.9	0.0	0.0	397
18	75.9	49.8	44.8	0.0	0.0	643	63.1	0.0	0.0	334
						597				
19 20	74.6 72.8	49.3 49.4	45.4 45.4	0.0 300.0	0.0 224.3	852	56.8 50.1	0.0 300.0	0.0 224.3	277 527
21	72.8 70.7					1,000	47.9	300.0	224.3	779
		48.5	45.1	193.0	143.3	•			194.1	1,000
22 23	68.3	47.1	43.8	43.8	31.1	1,000	46.3	267.5	31.3	1,000
23	65.8	45.8	42.0	42.0	30.0	1,000	44.1	44.1	31.3	1,000

28.6

1,000

41.6

41.6

29.7

1,000

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

July

					sign				
	Desi	gn	Cooling	Chiller		Storage			
	OADB	OAWB	Load	Load	Demand	Capacity			
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Kr)			
′1	79.1	56.4	83.5	83.5	58.9	1,000			
2	78.0	55.8	78.8	78.8	54.9	1,000			
3	77.2	55.5	75.0	75.0	51.8	1,000			
4	76.5	55.1	71.3	71.3	48.9	1,000			
5	76.3	55.9	68.4	68.4	47.0	1,000			
6	76.7	56.8	66.1	66.1	45.8	1,000			
			64.5	64.5	45.1	1,000			
7	77.8	57.7		72.2	50.9	1,000			
8	79.8	57.9	72.2		0.0	902			
9	82.6	59.0	97.8	0.0	0.0	793			
10	85.8	60.3	109.0	0.0	0.0	670			
11	89.5	61.3	123.4	0.0		535			
12	93.0	62.7	134.8	0.0	0.0	399			
13	95.6	63.5	136.0	0.0	0.0				
14	97.3	63.9	136.0	0.0	0.0	263			
15	98.0	64.0	136.0	0.0	0.0	127			
16	97.3	63.6	136.0	8.9	7.2	0			
17	95.8	62.6	136.0	136.0	108.8	0			
18	93.4	61.3	136.0	136.0	107.4	0			
19	90.6	60.1	136.0	136.0	106.1	0			
√ 20	87.8	58.5	120.1	300.0	235.8	180			
21	85.4	57.9	110.4	300.0	234.8	370			
22	83.2	57.5	102.0	300.0	234.2	568			
23	81.5	57.3	94.5	300.0	233.9	773			
24	80.2	56.9	89.5	300.0	233.3	984			
				W e	ekday			Sa	
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	
	OADB	OAWB	Load	Load	Demand	Capacity	Load	Load	
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	
1	79.5	63.5	82.7	99.1	84.4	1,000	97.8	192.0	
2	77.5	62.1		79.1	58.6	1,000	88.0	88.0	
3	75.7		75.4	75.4	55.1	1,000	83.1	83.1	
4	74.4			72.2	52.1	1,000	78.9	78.9	
5	73.6			69.1	50.1	1,000	75.2	75.2	
6	73.4			67.4	49.2	1,000	73.4	73.4	
7					48.2	1,000	71.4	71.4	
8	75.4				53.0	1,000	69.0	69.0	
				0.0	0.0	900	69.1	0.0	
9					0.0	784	73.1	0.0	
10					0.0	655	75.1	0.0	
11					0.0	519	81.0	0.0	
12					0.0	383	85.4	0.0	
13 14					0.0	247	90.2	0.0	
	3000			**			•		
						D14-2	.2		
15	94.6	68.3	3 136.0	0.0	0.0	111	94.8		
16			6 136.0	25.4	21.9	0	98.3		
						_	404.0		

136.0

136.0

68.4

115.4

0.0

101.9

0.0

231

34.3

24 81.8 65.0

95.2 269.7

218.3

1,000

109.7

300.0

247.9

901

10

	Weekday			Saturday						
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	OADB	. OAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
18	94.1	67.9	136.0	136.0	114.8	0	103.8	0.0	0.0	127
19	92.8	67.8	136.0	136.0	114.7	0	106.1	0.0	0.0	21
20	91.0	66.7	136.0	300.0	251.5	164	106.0	300.0	251.5	215
21	89.0	66.7	121.2	300.0	251.5	343	104.1	300.0	251.5	411
22	86.7	66.5	115.0	300.0	251.0	528	103.8	300.0	251.0	607
23	84.3	66.1	113.2	300.0	250.2	715	101.1	300.0	250.2	806
24	81.8	65.0	108.8	300.0	247.9	906	95.8	289.5	237.6	1,000
				s	unday			H	onday	
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	CADB	OAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	79.5	63.5	90.7	90.7	68.8	1,000	89.0	89.0	67.5	1,000
2	77.5	62.1	84.5	84.5	62.9	1,000	82.9	82.9	61.6	1,000
3	75.7	61.1	80.0	80.0	58.7	1,000	78.5	78.5	57.5	1,000
4	74.4	60.2	76.2	76.2	55.2	1,000	74.7	74.7	54.0	1,000
5	73.6	60.9	72.8	72.8	53.0	1,000	71.3	71.3	51.8	1,000
6	73.4	61.6	71.1	71.1	52.0	1,000	69.5	69.5	50.8	1,000
7	73.9	62.1	69.3	69.3	50.9	1,000	67.6	67.6	49.6	1,000
8	75.4	61.8	67.2	67.2	49.2	1,000	73.8	73.8	54.3	1,000
9	77.9	62.6	67.4	0.0	0.0	933	-	0.0	0.0	897
10	80.9	63.8	71.3	0.0	0.0	861.		0.0	0.0	779
11	84.3	64.4	73.6	0.0	0.0	788	130.8	0.0	0.0	648
12	87.6	65.8	79.3	0.0	0.0	708	136.0	0.0	0.0	512
13	90.7	66.9	83.9	0.0	0.0	624	136.0	0.0	0.0	376
14	93.1	67.6	88.7	0.0	0.0	536	136.0	0.0	0.0	240
15	94.6	68.3	93.3	0.0	0.0	442	136.0	0.0	0.0	104
16	95.1	68.6	96.9	0.0	0.0	346	136.0	32.0	26.7	0
17	94.9	68.4	100.6	0.0	0.0	245	136.0	136.0	115.4	0
18	94.1	67.9	102.6	0.0	0.0	142	136.0	136.0	114.8	0
19	92.8	67.8	105.0	0.0	0.0	37	136.0	136.0	114.7	0
20	91.0	66.7	105.0	300.0	251.5	232	136.0	300.0	251.5	164
21	89.0	66.7	103.2	300.0	251.5	429	125.2	300.0	251.5	339
22	86.7	66.5	103.0	300.0	251.0	626	115.0	300.0	251.0	524
23	84.3	66.1	100.5	300.0	250.2	826	113.2	300.0	250.2	711

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

August

Newspire and the second

			Design							
	Desig	an	Cooling	Chiller	Chiller	Storage				
	CADB	OAWB	Load	Load	Demand	Capacity				
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)				
nou.	.,,	• •								
1	77.2	55.7	92.4	191.6	145.5	1,000				
2	76.1	55.5	78.1	78.1	54.2	1,000				
3	75.2	55.4	72.5	72.5	49.9	1,000				
4	74.5	55.4	68.5	68.5	47.0	1,000				
5	74.3	55.9	65.1	65.1	44.8	1,000				
6	74.7	56.7	62.3	62.3	43.0	1,000				
7	75.8	57.4	60.9	60.9	42.2	1,000				
8	77.8	58.5	68.7	68.7	48.6	1,000				
9	80.7	59.3	96.2	0.0	0.0	904				
10	84.0	60.5	109.8	0.0	0.0	794				
11	87.7	61.6	125.3	0.0	0.0	669				
12	91.2	62.8	135.8	0.0	0.0	533				
13	93.9	63.5	136.0	0.0	0.0	397				
14	95.6	63.8	136.0	0.0	0.0	261				
15	96.3	63.3	136.0	0.0	0.0	125				
16	95.6	62.6	136.0	11.1	8.8	0				
17	94.1	61.5	136.0	136.0	107.6	0				
18	91.7	60.3	136.0	136.0		0				
19	88.8	59.1	135.3	135.3		0				
20	86.0	58.0	114.9	300.0		185				
21	83.5	57.4	110.0	300.0		375				
22	81.3	57.0	101.0	300.0		574				
23		56.6	90.	300.0		784				
24		56.2	2 84.0	5 300.1	0 232.2	999				

				Hai	ekday			Sa1	turday	
Hour	Typ OADB (F)	ical OAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
1 2 3 4 5 6 7 8 9 10 11 12 13	77.6 75.5 73.8 72.5 71.6 71.4 71.9 73.5 75.9 79.0 82.4 85.8 88.9 91.3	62.9 62.1 61.5 61.0 61.2 61.8 62.1 63.0 63.2 64.2 65.0 66.1 67.1	4	0.0 0.0 0.0	0.0	1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 902 790 663 528 392 256	90.9 85.7 80.4 76.1 71.9 68.3 65.5 66.0 65.1 67.0 70.4 74.7 80.9	0.0	0.0	1,000 1,000 1,000 1,000 1,000 1,000 1,000 1,000 935 868 798 723 642 557
15 16 17	93.4		4 136.0	0 16.	3 13.9	120 0 0	93.	4 0.0	0.0	467 374 278

SH Up. West

	Weekday					Saturday				
	Tvi	pical			Chiller				Chiller	
	OADB	OAWB	Load	Load	Demand	_	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
	,	·· ,	(10.1)	(,,,,,	(1117)	(10.1)	(10.17	(,,,,,	\ ,,	(15.11)
18	92.3	66.7	136.0	136.0	113.4	0	97.6	0.0	0.0	180
19	91.0	66.7	136.0	136.0	113.4	0	99.7	0.0	0.0	80
20	89.2	66.5	130.0	300.0	251.0	170	100.5	300.0	251.0	280
21	87.2	66.5	114.3	300.0	251.0	356	99.4	300.0	251.0	480
22	84.8	66.3	113.0	300.0	250.6	543	97.9	300.0	250.6	683
23	82.4	65.7	110.7	300.0	249.4	732	94.7	300.0	249.4	888
24	79.9	64.4	102.3	300.0	246.7	930	89.4	201.6	161.9	1,000
				S	undov			14	ondov	
	Tva	pical		Chiller	•	Storage		Chiller	•	Storage
	CADB	OAWB	Load	Load		_	Load	Load		Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
iloui	(1)	(,,	(1011)	(1011)	(84)	(1011 1117	(101)	(101)	(~ / /	(1011 111)
1	77.6	62.9	84.4	84.4	63.3	1,000	82.6	82.6	61.9	1,000
2	75.5	62.1	79.8	79.8	59.2	1,000	78.2	78.2	57.8	1,000
3	73.8	61.5	75.4	75.4	55.3	1,000	73.8	73.8	54.0	1,000
4	72.5	61.0	71.8	71.8	52.3	1,000	70.2	70.2	51.0	1,000
5	71.6	61.2	68.6	68.6	49.9	1,000	67.0	67.0	48.7	1,000
6	71.4	61.8	66.1	66.1	48.3	1,000	64.4	64.4	47.0	1,000
7	71.9	62.1	64.1	64.1	46.9	1,000	62.4	62.4	45.7	1,000
8	73.5	63.0	64.7	64.7	47.9	1,000	71.4	71.4	53.0	1,000
9	75.9	63.2	63.8	0.0	0.0	936T	98.9	0.0	0.0	901
10	79.0	64.2	65.7	0.0	0.0	870	112.0	0.0	0.0	789
11	82.4	65.0	69.2	0.0	0.0	801	126.5	0.0	0.0	663
12	85.8	66.1	73.4	0.0	0.0	728	135.5	0.0	0.0	527
13	88.9	67.1	79.5	0.0	0.0	648	136.0	0.0	0.0	391
14	91.3	67.7	83.7	0.0	0.0	565	136.0	0.0	0.0	255
15	92.9	67.5	88.1	0.0	0.0	477	136.0	0.0	0.0	119
16	93.4	67.4	92.2	0.0	0.0	384	136.0	16.8	14.3	0
17	93.1	67.0	95.3	0.0	0.0	289	136.0	136.0	113.7	0
18	92.3	66.7	96.6	0.0	0.0	192	136.0	136.0	113.4	0
19	91.0	66.7	98.7	0.0	0.0	94	136.0	136.0	113.4	0
20	89.2	66.5	99.5	300.0	251.0	294	135.5	300.0	251.0	164
21	87.2	66.5	98.5	300.0	251.0	496	114.6	300.0	251.0	350
22	84.8	66.3	97.1	300.0	250.6	699	113.3	300.0	250.6	537
23	82.4	65.7	94.0	300.0	249.4	905	110.9	300.0	249.4	726
24	79.9	64.4	88.8	184.3	150.6	1,000	100.6	300.0	246.7	925

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---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

October

16 77.6

17 77.3

				De	esign					
	Desig	an.	Cooling	Chiller	Chiller	Storage				
	OADB	OAWB	Load	Load	Demand	Capacity				
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)				
1	56.1	41.7	40.0	40.0	28.7	1,000				
2	54.7	41.2	36.8	36.8	26.6	1,000				
3	53.6	40.3	34.1	34.1	24.9	1,000				
_	52.8	40.2	31.7	31.7	23.3	1,000				
4		40.0	30.0	30.0	22.3	1,000				
5	52.5 53.1	40.6	28.7	28.7	21.4	1,000				
6 7	54.5	41.8	28.0	28.0	21.0	1,000				
-	57.0	43.5	32.7	32.7	24.0	1,000				
8	60.6	44.3	48.7	0.0	0.0	951				
9	64.8	46.1	55.3	0.0		896				
10	69.5	48.5	63.6	0.0	0.0	833				
11	74.0	50.9	77.9		0.0	755				
12	77.3	52.7			0.0	670				
13 14	79.6	53.5			0.0	576				
15	80.4	53.7			0.0	474				
16	79.6	52.7		_	0.0	365				
17	77.6	51.3				274				
18	74.5	49.8				193				
19	70.9	49.0			0.0	120				
20	67.3	48.1	_		0 223.3	356				
21	64.2	46.6		5 300.	0 222.5	597				
22	61.4				0 221.8	844				
23					4 149.5	1,000				
24					2 30.7	1,000				
Weekday										

								Sa1	turday	
					ekday	Storage	Cooling	Chiller	Chiller	Storage
	Тур	ical	Cooling	Chiller		-	Load	Load	Demand	Capacity
	OADB	OAMB	Load	Load	Demand	Capacity	(Ton)	(Ton)	(kW)	(Ton-Hr)
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(1011)	(1011)	•••••	
				/4.0	29.4	1,000	41.7	41.7	29.8	1,000
1	59.3	49.3	41.0	41.0	27.3	1,000	38.3	38.3	27.6	1,000
2	56.6	47.8	37.8	37.8	25.6	1,000	35.8	35.8	26.0	1,000
3	54.3	45.7	35.3	35.3	24.1	1,000	33.4	33.4	24.4	1,000
4	52.3	44.9	32.9	32.9		1,000	31.2	31.2	23.0	1,000
5	50.9	43.7	30.7	30.7	22.7	1,000	29.5	29.5	21.9	1,000
6	50.0	43.2	28.9	28.9	21.5	1,000	28.1	28.1	21.0	1,000
7	49.7	43.1	27.5		20.6	1,000	26.8	26.8	20.2	1,000
8	50.5	43.6	30.7		22.7	954	26.9	0.0	0.0	973
9	52.9	43.1	45.7		0.0	903	27.5	0.0	0.0	946
10	56.6	44.6	51.4		0.0	844	29.5		_	916
11	61.2	47.1	58.9		0.0	_	32.4			884
12	66.0	50.1	67.3	0.0		777	36.2			847
13	70.6	53.0	76.3	0.0	0.0	700				808
14	74.3	54.8	83.7	0.0	0.0	617	39.9	0.0		
						D14-2	26			
	, _	,	4 02	2 0.	0.0	525	43.	4 0.	0.0	764
15	76.7	7 56.	1 92.	۷.		/2/		1 0	n . 0.0	718

0.0

0.0

0.0

0.0

98.1

80.9

56.0

55.4

426

345

670

0.0

0.0

46.1

48.5

. 0.0

0.0

62.1 51.0

43.3

43.3

30.8

10

				Ue	ekdav			Sa	turday	
	Tv	pical		Chiller				Chiller	-	Storage
	OADB	OAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
11001	(1)	(,,	(101)	(1011)	(647)	(1011 111)	(10.13	(,,,,,	,,	(1.5 (
18	76.3	55.3	71.4	0.0	0.0	274	50.2	0.0	0.0	619
19	74.9	56.7	65.8	0.0	0.0	208	51.2	0.0	0.0	568
20	72.9	57.7	58.8	300.0	234.5	449	51.5	300.0	234.5	817
21	70.6	57.0	55.3	300.0	233.4	694	51.4	234.7	175.3	1,000
22	67.9	55.0	52.0	300.0	230.5	942	49.7	49.7	34.9	1,000
23	65.1	52.9	48.5	106.3	87.4	1,000	47.1	47.1	33.2	1,000
24	62.1	51.0	44.2	44.2	31.4	1,000	43.4	43.4	30.9	1,000
				s	unday			H	onday	
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	CADB	OAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	59.3	49.3	40.5	40.5	29.0	1,000	39.8	39.8	28.6	1,000
2	56.6	47.8	37.4	37.4	27.0	1,000	36.7	36.7	26.6	1,000
3	54.3	45.7	35.0	35.0	25.5	1,000	34.3	34.3	25.0	1,000
4	52.3	44.9	32.7	32.7	24.0	1,000	32.1	32.1	23.6	1,000
5	50.9	43.7	30.6	30.6	22.6	1,000	30.0	30.0	22.2	1,000
6	50.0	43.2	29.0	29.0	21.6	1,000	28.3	28.3	21.1	1,000
7	49.7	43.1	27.6	27.6	20.7	1,000	26.9	26.9	20.3	1,000
8	50.5	43.6	26.4	26.4	19.9	1,000	30.2	30.2	22.4	1,000
9	52.9	43.1	26.5	0.0	0.0	974 ₹	45.1	0.0	0.0	955
10	56.6	44.6	27.1	0.0	0.0	946	50.7	0.0	0.0	904
11	61.2	47.1	29.2	0.0	0.0	917	58.0	0.0	0.0	846
12	66.0	50.1	32.1	0.0	0.0	885	66.5	0.0	0.0	780
13	70.6	53.0	36.0	0.0	0.0	849	74.7	0.0	0.0	705
14	74.3	54.8	39.6	0.0	0.0	809	83.2	0.0	0.0	622
15	76.7	56.1	43.2	0.0	0.0	766	90.5	0.0	0.0	531
16	77.6	56.0	45.8	0.0	0.0	720	98.1	0.0	0.0	433
17	77.3	55.4	48.2	0.0	0.0	672	82.4	0.0	0.0	351
18	76.3	55.3	50.0	0.0	0.0	622	72.0	0.0	0.0	279
19	74.9	56.7	51.0	0.0	0.0	571	66.0	0.0	0.0	213
20	72.9	57.7	51.0	300.0	234.5	820	59.1	300.0	234.5	454
21	70.6	57.0	51.2	231.0	172.4	1,000	55.6	300.0	233.4	698
22	67.9	55.0	49.4	49.4	34.7	1,000	52.2	300.0	230.5	946
23	65.1	52.9	46.9	46.9	33.1	1,000	48.4	100.0	78.4	997

1,000

44.2

44.2

31.4

1,000

	JOB WSHR ESOS STUDY ENC#1110-000
-	SHEET NO
E M C ENGINEERS, INC.	CALCULATED BY
Denver • Colorado Springs • Atlanta • Germany	CHECKED BY DATE
D - THER MAI STORAGE SIZING	SCALE
P-300 THERMAL STORAGE SIZING FOR NEW MODIFIED CONFIG	UPATION

TRACE 600 RESULTS

IKACE		•	CHW EQUANT		
	Total BLDG CUNSUMPTION (RWh)	ELEC. ENGLGY SAVINGS (LWh)	ON-PEAK DEMAND (KW)	DEMAND REDUCTION (KW)	
MODIFIED CONFIGURATION WO TH. STORAGE	3,279,396		1463.5		
1500 ton-hi storage	3,283,663	(4,267)	0	1463.5	
storage	3,295,543	(6,147)	328.8	1134.7	
500 ton-hi storage	3,294,041	(14,645)	740	720.7	

REBATE CALCULATION: (ON PEAK = 10,000 R.M)

CHILLER COMPRESSOR LUAD (KW) AT JULY DESIGN BEAK LESS

MAXIMUM COMPRESSOR LOAD BURING ON PEAK DERIOD)

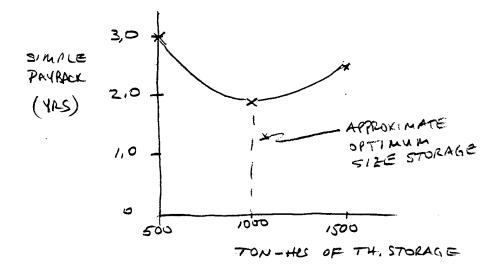
JULY BESIGN PEAK CHILLER LUAD = 115.4 kW (July, Monday, low 17)

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

JOB	
SHEET NO.	Z _{0F} 2
CALCULATED BY	TF DATE 10-20-92
CHECKED BY	DATE
SCALE	

TH, STO CAPACITY	ENERGY COST SAVINGS	DEMAND COST SUGS	CONSTR,	REPLATE	5/MOLE PAYBA	<u> </u>
500 tonk		#14,1.1.2	#41,250	0 *	3 , 0	YRS
1000 "	(4/36)	#22.127	# 82 SUO	\$22,000	1.9	
1500 "	(#94)	#28,538	#123,750	#22,000	2.5	4



APRILIMATELY 1000 TON-HIS IS THE DRTIMUM STORAGE

* THE 500 TON-HR STORAGE SYSTEM DOES NOT CARRY THE
PEAK COOLING LOAD IN JULY & AUGUST, SO DOES NOT
QUALIFY FOR THE UTILITY REBATE.

V 60 PAGE 71

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 MODIFIED CONFIGURATION WITHOUT THERMAL STORAGE

·					
	ELEC	DEMAND	GAS		GAS DMND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(k\h)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)
Jan	237,896	514	4,478	47	12
Feb	217,350	518	3,581	48	11
March	254,879	553	1,645	90	6
April	257,323	611	482	129	3
May	295,498	644	95	197	2
June	302,610	666	0	242	0
July	329,801	677	0	293	0
Aug	332,016	675	0	289	0
Sept	293,672	648	33	221	1
Oct	273,498	619	552	143	2
Nov	242,964	550	1,814	84	6
Dec	241,890	520	3,442	60	8
Total	3.279.396	677	16,123	1,843	12

Building Energy Consumption = 210,467 (Btu/Sq Ft/Year)
Source Energy Consumption = 211,287 (Btu/Sq Ft/Year)

فللفائنانة نبيد

loor Area = 60,840 (Sq Ft)

V 600

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EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

----- EQUIPMENT ENERGY CONSUMPTION ------

	_							_						
Ref								sumption			0-4		D	Tatal
Num	Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	0ct	Nov	Dec	Total
0	LIGHTS													
	ELEC	16830	15222	18120	16079	17475	17369	16185	18120	16079	17475	16079	16185	201,220
	PK	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3
1	MISC LD							•						
	ELEC	129522	117009	130910	125119	130216	126508	128827	130910	125119	130215	125119	128827	1,528,301
	PK	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2
2	MISC LD													
	GAS	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	MISC LD													
-	OIL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	MISC LD													
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	T 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	5 MISC LD													
	P HOTH20	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	MISC LD													
	P CHILL	0	0	0	0	0	0	0	.0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	EQ1070L	WTR-CLD RECIP >30 TONS												
	ELEC	9109	9188	16987	23691	30479	33845	32967	34604	31556	26426	15863	11475	276,189
	PK	36.2	38.6	52.7	66.1	71.2	70.5	78.8	78.5	72.0	70.4	51.7	39.4	78.8
1	EQ5101		COO	LING TOW	ER									
•	ELEC	563	626	1613	3551	5292	5948	6146	6146	5948	4422	1464	813	42,533
	PK	5.2	5.6	6.8	8.3	8.3	8.3	8.3	8.3	8.3	8.3	6.7	5.7	8.3
1	EQ5101		COO	LING TOW	ER									
	WATER	47	48	90	129	166	181	168	177	165	143	84	60	1,459
	PK	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.2	0.4
1	EQ5001	CHILLED WATER PUMP C.V.												
	ELEC	11108	10033	11108	10750	11108	10750	11108	11108	10750	11108	10750	11108	130,787
	PK	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9
1	EQ5011		CON	DENSER W	ATER PUM	IP C.V.								
	ELEC	8325	7520	8325	8057	8325	8057	8325	8325	8057	8325	8057	8325	98,024
	PK	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2

	e Air Condit Trane Custom			Network								36	2 4	V 600 PAGE 73
EQUI	PMENT ENERGY	CONSUMPTI	ON - AL	TERNATIV	E 1									
	Contrais		,	77/	72	74	72	74	74	72	74	72	74	876
	ELEC PK	74 0.1	67 0.1	74 0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
			2 07	G CTV <5	EE TONG									
2	EQ1001S ELEC	0	2-51	0	0	5401	10663	22894	20553	9932	0	0	0	69,443
	PK	0.0	0.0	0.0	46.7	55.8	60.2	64.1	63.5	61.5	48.5	0.0	0.0	64.1
,	EQ5100		COOL	ING TOWE	R									
2	ELEC	0	0	0	0	1782	3208	6433	5655	2917	0	0	0	19,995 16.2
	PK	0.0	0.0	0.0	16.2	16.2	16.2	16.2	16.2	16.2	16.2	0.0	0.0	10.6
2	EQ5100		COOL	ING TOWE	R								_	70/
-	WATER	0	0	0	0	31	61	124	113	55	0	0.0	0 0.0	384 0.3
	PK	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.5
2	EQ5001		CHIL	LED WATE	R PUMP C	.۷.						_		0
-	ELEC	0	0	0	0	0	0	0	0	0	0.0	0 0.0	0 0.0	0.0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	•••
2	EQ5010		CON	ENSER W	ATER PUMP	c.v.						•	•	0
	ELEC	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0 0.0	0.0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
2	EQ5300		CON	TROL PAN	EL & INTE				7/0	400	0	0	0	1,234
	ELEC	0	0	0	0	110	198 1.0	397 1.0	349 1.0	180 1.0	1.0	0.0	0.0	1.0
	PK	0.0	0.0	0.0	1.0	1.0	7 1.0	1.0	1.0	,,,,	•••			
1	EQ4002		BI		FAN C.V.		-\	2707/	22070	18735	16169	14082	14447	204,411
	ELEC	13896	12820	14538	15163	18897	19610 46.7	23076 47.1	22978 47.1	41.4	39.8	25.7	23.6	47.1
	PK	22.6	23.6	29.2	35.8	41.0	40.7	71	4	****				
2	EQ4002				FAN C.V.		44094	18586	18987	16286	15273	13134	12731	180,340
	ELEC	12312	11304	13733 26.4	14424 30.9	16584 31.5	16986 33.6	33.6	33.6	32.0	30.9	26.2	24.6	33.6
	PK	24.0	24.3	20.4	30.7	31,3	55.0	2010						
3	EQ4002				FAN C.V.	45352	49397	54781	54206	44859	39117	31679	30473	473,592
	ELEC PK	28681 65.4	26808 67.0	32652 81.3	35588 91.9		118.7		119.4	106.5	94.8	82.7	67.8	119.4
•	EQ2001	1476	GAS 1186		BE HOT W	34	0	0	0	17	183	597	1134	5,314
	GAS PK	3.8	3.4	1.7		0.4	0.0		0.0	0.3	0.7	1.9	2.6	3.8
	1 505030		UE A	AT WATED	CIRC. PU	MP C.V.								
	1 EQ5020 ELEC	278	251		138	50	0	0		22	144	254	278	1,674
	PK	0.4	0.4		0.4	0.4	0.0	0.0	0.0	0.4	0.4	0.4	0.4	0.4
	1 EQ5240		BO	ILER FOR	CED DRAFT	FAN								
	ELEC	1109	1001			861	0			939	814	1073	1109	9,019
	PK	1.5	1.5		1.5	1.5	0.0	0.0	0.0	1.5	1.5	1.5	1.5	1.5
	1 EQ5307		во	ILER CON	TROLS									
	ELEC	223	202	223	202	173				189	164	216	223	1,816 0.3
	PK	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.5

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Trane Air Conditioning Economics											V 600			
By:	Trane Custor	mer Direct	Service	Network								4-05-	4	PAGE 74
EQUI	PMENT ENERGY	r CONSUMPT	ION - AL	TERNATIV	E 1									
	Gas Fire Tobe Hot Water													
	GAS	876	726	375	131	32	0	0	0	16	159	419	724	3,459
	PK	2.4	1.8	1.1	0.6	0.4	0.0	0.0	0.0	0.3	0.6	1.2	1.5	2.4
2	EQ5020 HEAT WATER CIRC. PUMP C.V.													
	ELEC	833	752	677	347	104	0	0	0	67	416	690	833	4,719
	PK	1.1	1.1	1.1	1.1	1.1	0.0	0.0	0.0	1.1	1.1	1.1	1.1	1.1
2	EQ5240 BOILER FORCED DRAFT FAN													
	ELEC	1109	1001	1109	626	1062	0	0	0	268	781	1073	1109	8,137
	PK	1.5	1.5	1.5	1.5	1.5	0.0	0.0	0.0	1.5	1.5	1.5	1.5	1.5
2	EQ5307	Q5307 BOILER CONTROLS												
	ELEC	223	202	223	126	214	0	0	0	54	157	216	223	1,638
	PK	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3
3	EQ2001	001 GAS FIRE TUBE HOT WATER												
	GAS	2126	1668	742	192	28	0	0	0	0	211	799	1584	7,350
	PK	5.9	5.4	2.9	1.4	0.9	0.0	0.0	0.0	0.0	1.4	3.1	4.2	5.9
3	E05020	HEAT WATER CIRC. PUMP C.V.												
	ELEC	1665	1504	1182	414	69	0	0	0	0	517	1173	1620	8,144
	PK	2.2	2.2	2.2	2.2	2.2	0.0	0.0	0.0	0.0	2.2	2.2	2.2	2.2
3	EQ5240	40 BOILER FORCED DRAFT FAN												
	ELEC	1665	1504	1665	1611	1526	0	0	0	1343	1553	1611	1665	14,144
	PK	2.2	2.2	2.2	2.2	2.2	→ 0.0	0.0	0.0	2.2	2.2	2.2	2.2	2.2
3	EQ5307		BOIL	ER CONTR	OLS	,								
	ELEC	372	336	372	360	341	0	0	0	300	347	360	372	3,160
	PK	0.5	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.5

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

MOD CONFIG - BLDG 300 WITHOUT VAV

Montfi	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 GL)	GAS DMND On Peak (Thrm/hr)	
Jan	351,780	626	6,514	137	14	
Feb	318,420	626	5,274	127	14	
Warch	360,536	643	2,530	174	8	
April	355,974	679	586	220	3	į
May	387,033	696	9	317	0	
June	391,920	717	0	377	0	
July	409,254	726	0	412	0	
Aug	410,673	720	0	399	0	
Sept	376,847	698	0	314	0	
Oct	373,457	680	782	241	4	
Nov	345,639	645	2,834	167	9	
Dec '	352,402	628	5,204	147		
Total	4,433,935	726	23,732	3,032	14	
	Tongu Congumntion	= 287.	740 (Btu/S	q Ft/Year)	F	loor Area =

Building Energy Consumption = 287,740 (Btu/Sq Ft/Year)
Source Energy Consumption = 288,947 (Btu/Sq Ft/Year)

and the contract

60,840 (Sq Ft)

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EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2 MOD CONFIG - BLDG 300 WITHOUT VAV

------ EQUIPMENT ENERGY CONSUMPTION ------

nad	i							. •						
Ref Num		Jan	Feb	Mar	Ann	May	nthly Cor June	nsumption July			0-+	Have	Daa	Takal
NCAII	Code	vaii	reb	Mai	Apr	may	June	July	Aug	Sep	0ct	Nov	Dec	Total
0	LIGHTS													
	ELEC	16830	15222	18120	16079	17475	17369	16185	18120	16079	17475	16079	16185	201,220
	PK	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3	88.3
1	MISC LD													
	ELEC	129522	117009	130910	125119	130216	126508	128827	130910	125119	130215	125119	128827	1,528,301
	PK	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2	236.2
ż	MISC LD													
	GAS	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	MISC LD													
	OIL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	MISC LD													
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	T 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	5 MISC LD													
	P HOTH20	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	MISC LD													
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	EQ1070L		WTR	-CLD REC	IP >30 T	ONS								
	ELEC	25085	23281	31385	32200	30020	26957	27345	27614	31344	34134	29293	26908	345,568
	PK	56.9	58.9	67.7	67.8	67.9	70.3	54.0	74.8	74.7	72.0	65.7	60.6	74.8
1	EQ5101		COO	LING TOW	ER			4				•		
	ELEC	3503	3266	4242	4816	5846	5948	6146	6146	5948	5448	3973	3732	59,014
	PK	7.3	7.4	7.6	8.3	8.3	8.3	8.3	8.3	8.3	8.3	7.6	7.5	8.3
1	EQ5101		COO	LING TOW	ER									
	WATER	137	127	174	179	165	144	139	141	164	188	162	147	1,866
	PK	0.3	0.3	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.3	0.4
1	E95001		CHII	LLED WAT	ER PUMP	c.v.								
	ELEC	11108	10033	11108	10750	11108	10750	11108	11108	10750	11108	10750	11108	130,787
	PK	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9
1	EQ5011		CONI	DENSER W	ATER PUMI	P C.V.								
	ELEC	8325	7520	8325	8057	8325	8057	8325	8325	8057	8325	8057	8325	98,024
	PK	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2

EQUIPMENT EMBROY COMBINETION - ALTERNATIVE 2 COLOR		itioning Ec omer Direct		e Network	:							2	054	V 600 PAGE 73	
ELEC						Æ 2								•	
Column C			CONT	200									=-		97/
2 E010015 2-STG CTV -555 TONS ELEC		ELEC		67											
ELEC 0 0 0 0 7188 25986 40020 48556 48116 26645 9243 919 0 224,615		PK	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
ELEC 0 0 0 0 7188 25986 40020 48556 48116 26645 9243 919 0 224,615	2	F01001S		2-S1	rg ctv <5	55 TONS									
PK	-		0				25898	40020	48586	46116	26645	9243	919	0	204,615
ELEC 0 0 0 1863 7454 10555 12055 11683 7356 2852 103 0 53,7930 PK 0.0 0.6 3 16.2 16.2 16.2 16.2 16.2 16.2 16.2 16.2					50.5		75.9	89.1	94.6	90.8	77.2	63.7	49.8	0.0	94.6
ELEC 0 0 0 184S3 7-554 10565 12055 11633 7536 2652 103 0 53,7930 PK 0.0 0.0 6.3 16.2 16.2 16.2 16.2 16.2 16.2 16.2 16.2	2	EQ5100		COOL	LING TOW	ER .									
2 E05101	_		0	0	0	1863	7454								
MATER PK 0.0 0 0 41 152 233 273 258 150 54 5 0 1,166 PK 0.0 0.0 0.3 0.4 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.4 0.3 0.0 0.5 2 E05001		PK	0.0	0.0	6.3	16.2	16.2	16.2	16.2	16.2	16.2	16.2	6.1	0.0	16.2
MARK PK 0.0 0.0 0.3 0.4 0.5 0.5 0.5 0.5 0.5 0.5 0.5	2	EQ5100		COO	LING TOW	ER									
2 E05010 ELEC	_		0	0	0	41	152	233	273						
ELEC			0.0	0.0	0.3	0.4	0.5	0.5	0.5	0.5	0.5	0.4	0.3	0.0	0.5
ELEC	2	EQ5001		CHI	LLED WAT	ER PUMP (c.v.								
PK	-		0					0	0	0	0	0	0	0	
ELEC			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ELEC	2	FQ5010		CON	DENSER W	ATER PUMI	P C.V.								
PK 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	_		0					0	0	0	0	0	0		0
ELEC						0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ELEC	,	E05300		CON	TROL PAN	EL & INTI	ERLOCK								
PK 0.0 0.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	-		۵					652	744	721	454	176	20	0	3,367
EQ4002 BI CENTRIF. FAN C.V. 73 74 75 75 75 75 75 75 75									1.0	1.0	1.0	1.0	1.0	0.0	1.0
ELEC NA SECTION NAME NAME NAME NAME NAME NAME NAME NAM					CENTR! E	EAN C V									
PK 48.5 48.5 48.5 48.5 48.5 48.5 48.5 48.5	1		74077						36077	36077	34913	36077	34913	36077	424,773
ELEC 24976 22559 24976 24170 24976 24170 24976 24976 24170 24976 24170 24976 24170 24976 29476 24170 24976 24170 24976 24170 24976 294,073 24976 24170 24976 24170 24976 24170 24976 24170 24976 294,073 24976 24170 24170 24110 241														48.5	
ELEC 24976 22559 24976 24170 24976 24170 24976 24976 24170 24976 24170 24976 24170 24976 29476 24170 24976 24170 24976 24170 24976 294,073 24976 24170 24976 24170 24976 24170 24976 24170 24976 294,073 24976 24170 24170 24110 241	_			••		FAU 6 V									
PK 33.6 33.6 33.6 33.6 33.6 33.6 33.6 33.	2		2/07/					2/,170	24076	24976	24170	24976	24170	24976	294,073
SEQUODE BI CENTRIF. FAN C.V. SELEC 88804 80210 88804 85939 8804 85939 88804 85939 88804 85939 88804 85939 88804 85939 88804 85939 88804 85939 88804 85939 88804 85939 88804 85939 88804 85939 88804 85939 88804 85939 88804 85939 8804 85939 8804 85939 8804 85939 8804 85939 8804 85939 8804 85939 8804 85939 8804 85939 8804 85939 8804 85939 8804 85939 8804 85939 8804 85939 8804 85939 8804 85939 8804 85939 8804 85939 8804 1045															
ELEC 88804 80210 88804 85939 88804 85939 88804 88904 85939 88804 85939 88804 1,045,593 PK 119.4		F N	33.0												
PK 119.4 119	3							25070	9990/	8000/	95070	9990/	85030	አበጻጻዪ	1 045 593
1 EQ2001 GAS FIRE TUBE HOT WATER GAS 1886 1540 835 256 9 0 0 0 0 0 306 914 1561 7,307 PK 3.7 3.6 2.3 1.2 0.3 0.0 0.0 0.0 0.0 1.3 2.5 3.1 3.7 1 EQ5020 HEAT WATER CIRC. PUMP C.V. ELEC 278 251 235 123 12 0 0 0 0 127 246 278 1,548 PK 0.4 0.4 0.4 0.4 0.4 0.4 0.0 0.0 0.0 0.0															• •
GAS 1886 1540 835 256 9 0 0 0 0 306 914 1561 7,307 PK 3.7 3.6 2.3 1.2 0.3 0.0 0.0 0.0 0.0 1.3 2.5 3.1 3.7 1 EQ5020 HEAT WATER CIRC. PUMP C.V. ELEC 278 251 235 123 12 0 0 0 0 127 246 278 1,548 PK 0.4 0.4 0.4 0.4 0.4 0.0 0.0 0.0 0.0 0.4 0.4		PK	119.4	119.4	119.4	119.4	119.4	119.4	119.4	117.4	117.4	117.4	117.4	117.4	117.4
PK 3.7 3.6 2.3 1.2 0.3 0.0 0.0 0.0 0.0 1.3 2.5 3.1 3.7 1 EQ5020 HEAT WATER CIRC. PUMP C.V. ELEC 278 251 235 123 12 0 0 0 0 127 246 278 1,548 PK 0.4 0.4 0.4 0.4 0.4 0.0 0.0 0.0 0.0 0.0	1	EQ2001		GAS	FIRE TU	BE HOT W	ATER .								
1 EQ5020		GAS	1886	1540	835	256	9	0			-				•
ELEC 278 251 235 123 12 0 0 0 0 127 246 278 1,548 PK 0.4 0.4 0.4 0.4 0.4 0.0 0.0 0.0 0.0 0.0		PK	3.7	3.6	2.3	1.2	0.3	0.0	0.0	0.0	0.0	1.3	2.5	3.1	3.7
PK 0.4 0.4 0.4 0.4 0.4 0.0 0.0 0.0 0.0 0.0	1	EQ5020		HEA	AT WATER	CIRC. PU	MP C.V.								
1 EQ5240 BOILER FORCED DRAFT FAN ELEC 1109 1001 1109 894 240 0 0 0 0 554 1073 1109 7,088 PK 1.5 1.5 1.5 1.5 1.5 0.0 0.0 0.0 1.5 1.5 1.5 1.5 1 EQ5307 BOILER CONTROLS ELEC 223 202 223 180 48 0 0 0 0 112 216 223 1,427		ELEC	278	251	235	123	12	0	0						•
ELEC 1109 1001 1109 894 240 0 0 0 0 554 1073 1109 7,088 PK 1.5 1.5 1.5 1.5 1.5 0.0 0.0 0.0 1.5 1.5 1.5 1.5 1 EQ5307 BOILER CONTROLS ELEC 223 202 223 180 48 0 0 0 0 112 216 223 1,427		PK	0.4	0.4	0.4	0.4	0.4	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4
ELEC 1109 1001 1109 894 240 0 0 0 0 554 1073 1109 7,088 PK 1.5 1.5 1.5 1.5 1.5 0.0 0.0 0.0 1.5 1.5 1.5 1.5 1 EQ5307 BOILER CONTROLS ELEC 223 202 223 180 48 0 0 0 0 112 216 223 1,427	1	EQ5240		воз	LER FORC	ED DRAFT	FAN								
PK 1.5 1.5 1.5 1.5 0.0 0.0 0.0 0.0 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	•		1109					0	0	0				1109	
ELEC 223 202 223 180 48 0 0 0 0 112 216 223 1,427			1.5	1.5	1.5	1.5	1.5	0.0	0.0	0.0	0.0	1.5	1.5	1.5	1.5
ELEC 223 202 223 180 48 0 0 0 0 112 216 223 1,427	1	E05307		BOI	ILER CONT	rols									
	•		223				48	0	0	0	0	112	216	223	
								0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3

Sec. 236 (2)

minimitiniii

Tra	ne Air Condit	ioning E	conomics											V 600
Ву:	Trane Custom	er Direct	t Service	e Network	:							4	OF 4	PAGE 74
EQU	IPMENT ENERGY	CONSUMPT	TION - AL	TERNATIV	E 2									
MOD	CONFIG - BLD	G 300 WIT	THOUT VAV	1										
		GAS	FIRE	FTU A	Eun	ATER A	+CATE	<u> </u>						
	GAS	1418	1179	624	180	0	0	0	0	0	217	690	1192	5,500
	PK	2.9	2.9	1.8	0.9	0.0	0.0	0.0	0.0	0.0	1.0	2.0	2.5	2.9
2	EQ5020		HEAT	WATER C	IRC. PUM	P C.V.								
	ELEC	833	752	660	313	0	0	0	0	0	333	694	833	4,418
	PK	1.1	1.1	1.1	1.1	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1	1.1
2	EQ5240		BOIL	ER FORCE	D DRAFT	FAN								
	ELEC	1109	1001	1109	894	0	0	0	0	0	948	1073	1109	7,241
	PK	1.5	1.5	1.5	1.5	0.0	0.0	0.0	0.0	0.0	1.5	1.5	1.5	1.5
2	EQ5307		BOIL	ER CONTR	OLS									
	ELEC	223	202	223	180	0	0	0	0	0	191	216	223	1,458
	PK	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3
3	EQ2001		GAS	FIRE TUB	E HOT WA	TER								
	GAS	3210	2555	1071	150	0	0	0	0	0	259	1229	2451	10,925
	PK	7.5	7.2	3.9	1.6	0.0	0.0	0.0	0.0	0.0	1.7	4.5	5.9	7.5
3	EQ5020		HEAT	WATER C	IRC. PUM	P C.V.								
	ELEC	1665	1419	920	278	0	0	0	0	0	416	962	1576	7,235
	PK	2.2	2.2	2.2	2.2	0.0	0.0	0.0	0.0	0.0	2.2	2.2	2.2	2.2
3	EQ5240		BOIL	ER FORCE	D DRAFT	FAN								
	ELEC	1665	1504	1665	1477	0	0	0	0	0	1526	1432	1665	10,935
	PK	2.2	2.2	2.2	2.2	0.0	0.0	0.0	0.0	0.0	2.2	2.2	2.2	2.2
3	EQ5307		BOIL	ER CONTR	OLS	<i>~</i> s								
	ELEC	372	336	372	330	0	0	0	0	0	341	320	372	2,443
	PK	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5

Trane Air Conditioning Economics By: Trane Customer Direct Service Network

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3 MOD CONFIG - BLDG 300 MINUS NEW CHIL PLT

	ELEC	DEMAND	GAS		GAS DMND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(kWh)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)
Jan	243,097	532	4,478	51	12
Feb	224,201	535	3,581	53	11
March	266,268	569	1,645	97	6
April	274,584	625	482	134	3
May	315,753	663	95	201	2
June	323,682	688	0	245	0
July	347,964	697	0	295	0
Aug	351,172	695	0	292	0
Sept	315,554	671	33	224	1
Oct	293,754	633	552	149	2
Nov	253,297	566	1,814	91	6
Dec	250,829	537	3,442	66	8
Total	3,460,157	697	16,123	1,896	12

Building Energy Consumption =

220,607 (Btu/Sq Ft/Year)

60,840 (Sq Ft) Floor Area =

Source Energy Consumption =

221,427 (Btu/Sq Ft/Year)

identification in the second

V 60 PAGE 78

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

	ELEC	DEMAND	GAS		GAS DMND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(kWh)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)
Jan	239,240	535	4,413	48	12
Feb	218,464	540	3,512	48	11
March	257,005	582	1,615	92	6
April	258,995	638	471	132	3
May	298,097	668	96	201	2
June	304,983	690	0	247	0
July	331,334	701	0	298	0
Aug	333,977	699	0	295	0
Sept	295,764	672	34	226	1
Oct	276,111	635	544	147	2
Nov	244 796	578	1 785	86	6

547

701

Building Energy Consumption =

analitii)

3,379

15,848

Floor Area =

60,840 (Sq Ft)

211,279 (Btu/Sq Ft/Year) 212,085 (Btu/Sq Ft/Year) Source Energy Consumption =

243,174

3,301,940

EMonthly KW = 7,485

1,879

------ MONTHLY ENERGY CONSUMPTION ------

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

P-300 ECO#6 THERMAL STOLAGE

REBATE CALCULATION:

DESIGN LOAD: EAST WING

EAST WING 39.4T Simultaneous west wind 52.0T at 1600hn on July 7 320.4 TON

COMPRESSOR LUAD = 0.9 KW x 3 20.4T = 288.4 kW.

RERATE = \$140 × 28814 = \$54,788

		LOCATION: Whit		<u>-</u>	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				- ENERGY EFFICIENT	LAMPS & BALLASTS		FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/10/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
	1813	ECTUENT						
1		VESTMENT						
		CONSTRUCTION	COST	=			\$281	
		SIOH COST		(5.5% of 1A) =			\$15	
		DESIGN COST		(6.0% of 1A) =			\$17	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$313	
		SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	ENT	(1D - 1E) =			>	\$313
9	EN	ERGY SAVINGS (+)	/COST/-)					
_	_14	FUEL TYPE	FUEL COST	CAV/INICO	A 1811 141 A	Dissource	DIOCOLUSTEE	
		. VEL TIFE	\$/MBTU (1)	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
	Δ	ELEC	\$6.48	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
		DIST	φ0.40	1	\$7	15.23	\$112	
		NAT GAS	\$2.21	0	\$0	17.28	\$0	
		PAPER	₽ Æ.∠ I	0	\$0	19.64	\$0	
		COAL		0	\$0		\$0	
		TOTAL		4	\$0	16.22	\$0	
	г.	TOTAL		1	7.3		> >	\$112
3	NO	N-ENERGY SAVIN	GS (+) / COST	(–)				
				C. DEMAND SAVINGS)	=		\$ 35	
		1 DISCOUNT FAC		,	(From Table A-2) =	14.68	4 -5-5	
		2 DISCOUNTED S	SAVINGS (+) / C	OST (-)	(3A x 3A1) =		\$515	
	В.	NON-RECURRING		• •	(5		40.0	
		ITEM	` ,		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0		. 0.00	\$0	
	C.	TOTAL NON-ENE	RGY DISCOUN	ITED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) ≠	40	\$515
		PROJECT NON-E		(·/·	,	(5/2 / 5554) =		4010
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$37	
		a !F 3D1 => 3C 1	THEN GO TO 4			(a. o x o.oo) =	40,	
		b IF 3D1 < 3C Th	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =	0.47	
		c IF 3D1b => 1 T				(_, _ , _ , _ , , , , , , , , , , , , ,	0.47	
				DOES NOT QUALIFY				
		IST YEAR DOLLAR	• •	` '	(2F3	+ 3A + (3B1d/25)) =		\$42
		TAL NET DISCOUN				(2F5 + 3C) =		\$627
6				TMENT RATIO (SIR)		(5/1F) ±		2.00
		SIR < 1 THEN PRO		IOT QUALIFY)				
7	SIM	IPLE PAYBACK (SP	B)			(1F/4) =		7.38

		LOCATION: White	e Sands Missile	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	BLDG. 21140	- DESTRATIFICATION	FANS		FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/10/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
. 1	iN۱	/ESTMENT						
	A.	CONSTRUCTION	COST	=			\$4,077	
	В.	SIOH COST		(5.5% of 1A) =			\$224	
	C.	DESIGN COST		(6.0% of 1A) =			\$245	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$4,546	
	E.	SALVAGE VALUE		*			\$0	
	F.	TOTAL INVESTME	NT	(1D – 1E) =			>	\$ 4,548
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$18.37	13	\$234	15.23	\$3,569	
	B.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	0	\$0	19.64	\$0	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		13	234.3		>	\$3,569
3	NC	N-ENERGY SAVIN	GS (+) / COST	(-)				
	A.	ANNUAL RECURR	ING (+/-) (MAII	NTENANCE SAVINGS)	=		\$100	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	AVINGS (+) / C	OST (-)	(3A x 3A1) =		\$1,468	
	В.	NON-RECURRING	i (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		C.		\$0		0.00	\$0	
	_	d TOTAL	201200111	\$0	· ·	(242 27.11)	\$0	** ***
		PROJECT NON-E		ITED SAVINGS (+) / COS	SI (-)	(3A2 + 3Bd4) =		\$1,468
	U.	1 25% MAXIMUM		CALCIII ATION		(2F5 x 0.33) =	\$1,178	
		a IF 3D1 => 3C 1				(2F5 x 0.55) =	\$1,176	
		b IF 3D1 < 3C Th				(2F5 + 3D1) / 1F =	1.04	
		c IF 3D1b => 1 T				(2.5 : 52 :):		
				DOES NOT QUALIFY				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$334
		TAL NET DISCOUN	, -	• •	(21 3	(2F5 + 3C) =		\$5,037
				TMENT RATIO (SIR)		(5/1F) =		1.11
		F SIR < 1 THEN PRO				(5) =		****
7		MPLE PAYBACK (SP		•		(1F/4) =		13.60
		•				, ,		

		CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKD	NWC							
CONTRACTOR		EMC ENGINEERS INC.			ADDRESS 2750 SO	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	ORTH BLVI	D., #C-200,	DENVER, C	0 80227	
CONTRAC	ACT FOR (CONTRACT FOR (Work to be performed) ECO'S — BLDG, 21140		-				PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
PURCHAS	SE REQU	PURCHASE REQUEST NUMBER			PROJECT NUMBER	WBER		WORK LOCATION WHITE SAN	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
	-				MATERIAL COST	AL COST		LABOR COSTS			
Line	Ф	Item	Onit of	Quantity			Manhours	Average		Other Direct	Line
Š.		(2)	Measure (2)	. 6	Unit	Total	Mandays	Rate	Total	Costs	Total
-	25	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS	(2)			G	6	3	(c)	(2)	
		4 FT. ENERGY EFFICIENT LAMPS	EA	12	2.19	26.28	0.09	27.60	29.15		\$55.43
		ENERGY EFFICIENT BALLASTS	EA	9	14.06	84.36	0.85	27.60	140.93	•	\$225.29
T		TOTAL									\$280.71
N 015-3	<u> </u>	DESTRATIFICATION FANS									
1	-	HEAVY DUTY CEILING FANS	EA	4	218.00	872	5.00	27.60	552.00		\$1,424.00
		CEILING FAN SPEED CONTROLS	EA	4	24.55	98.2	0:20	27.60	55.20		\$153.40
		ELECT. CONDUIT, WIRING, & CNTRL WIRING	EA	+	2500	2500	2500 Includes Labor, Material, & Equip.	r, Material, &	Equip.		\$2,500.00
		TOTAL									\$4,077.40
		TOTAL THIS SHEET									\$8,716.22
	Mate	Material Source: Lighthulb Supply Co. Denvey CO. and McMaster, Carr Supply Co.	Chlores	M - Privae Includ	le 2504 Overhee	d & Profit- 1 shor Cour	11 0 Part of 1 al	0.000	A solute Ale Millor		

CALCULATED BY: A.S. DATE: 6/24/92
CHECKED BY: AMP. DATE: 6/24/92

LIGHTING

ENERGY SAVINGS CALCULATIONS

	DEMAND ENERGY ANNUAL CONSTRUCTION	COST	ESTIMATE		\$9:0923
	ANNOAL	# FIXTURES TYPE FIXTURE TOTAL KWHIYR REDUCTION SAVINGS ELECTRICAL	(KW) (KWH) COST SAVINGS	\$42.43	\$42.43
	ENERGY	SAVINGS	(KWH)	0.150 331.5	331.5
	DEMAND	REDUCTION	(KW)	. :	0.150
		KWH/YR		FL 0.071 0.426 941.5	941.5
		TOTAL	(KW)	0.426	
	PROPOSED	FIXTURE	(KW) (KW)	0.071	
; •	P.R.	TYPE		F	
		# FIXTURES		9	
		KWH/YR		1273.0	1273.0
		TOTAL	(KW)	0.576	
	EXISTING	FIXTURE	(KW)	0.096 0.576	
	ш	TYPE		교	
		SLDG. # HRS/YR # FIXTURES TYPE FIXTURE TOTAL KWH/YR		•	
		# HRS/YR		2210	
		BLDG.		21140	

1280.71

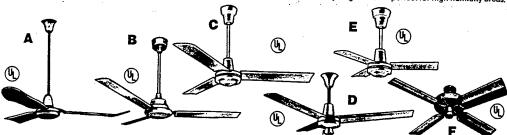
KEY:

FL = FLUORESCENT IN = INCANDESCENT MV = MERCURY VAPOR MH = METAL HALIDE

CEILING FANS

Whatever the season, there's a reason to use a ceiling fan. Winter-Fans recover wasted heat by pushing heated air down from the ceiling. The elimination of cold spots increases employee

productivity and comfort. Summer-Fans recirculate non airproductivity and commercial summer ratio recinition and conditioned air to create a cooling breeze. They help eliminate moid and mildew caused by stagnant air—perfect for high humidity areas.



A 56° CEILING FAN WITH STEEL BLADES—Fan features three steel blades with steel support arms to insure correct blade angle for maximum efficiency. Blades have a white enamel finish. Ideal for commercial and industrial buildings.

115 V, 60 Hz motor draws 0.70 amps at 260 rpm. Maximum circulation is 20,513 cfm at 20 ft.

B 56" SPRAY AND DUST RESISTANT CEILING FAN-This fan B can be used safely in wet locations—completely impervious to humidity, water, dust, and airborne debris. Ideal for steel mills, foundries, factories, warehouses, food processing plants, poultry barns, and auto repair centers where tans must be cleaned with a

buildings where there's a lot of area to cover.

120 V, 60 Hz motor draws 1.4 amps at 315 rpm. Maximum circulation is 48,000 cfm at 20 ft. Motor is totally enclosed and features

lation is 45,000 cm at 20 ft. Motor is totally enclosed and leatures thermal-overload protection.

Fan has 60" dia. aluminum blades with white epoxy enamel finish, permanently sealed and greased bearings, and 24" downrod. Mount fan at least 10 ft. above floor. Safety cable is included. UL Listed.

D 56" ALL SEASON CEILING FANS - Select standard 1-speed

models or 3-speed fan with pull chain. Totally-enclosed, thermal overload protected motors operate on 50/60 Hz. 55° dia. alumnum fan blades have a corrosion-resistant white epoxy enamel finish. Fans have a 24' downrod; 3-speed fan has an extra 8" rod. 3-speed fan can be suspended minimum of 7 ft. from the floor. Mount other fans at least 10 ft. from floor. Safety cable is included. UL Listed. Max. Max. CFM

Volts 1-SPEED	Amps FANS	RPM	at 20 ft.	No.	NET EACH
120	0.90	265	23,000	1917	(21 \$127.27
277	0.44	260	26 000	10171	(25 12070
3-24FER	FAN WITH	PULL CHAI	N		
120	1.00	265	25,500	19171	(23 135.55

E 36" AND 48" CEILING FANS—Economical, reliable fans are great for small areas. Capacitor-style, totally enclosed motors operate on 120V, 50/60 Hz. Aluminum blades are mounted on steel operate on 1204, 50/60 nz. Aluminum places are mounted on size blade holders for vibration-free service. Corrosion-resistant, white epoxy enamel finish. UL Listed.

36"	Amps 0.47	Max. RPM 395	8 610	No. NET	10764
48"	0.60	315	18,600	2056K84	90.43

3-SPEED ELECTRICALLY REVERSIBLE CEILING FANS—Ideal for rooms with low ceilings. The 42" model has reversible white pickled oak wood blades with white motor and irons. The 52" model has reversible hardwood blades that are walnut on one side: oak on the other. Both have a brown cast-iron housing. Reversible motors have precision-ground ball bearings and oil bath lubrication for long life. A pull chain controls on/off and three speeds. Motors operate on 120 V, 60 Hz. Mounting kit for 8-ft. ceilings is included. UL Listed. Blade Max. RPM Max.

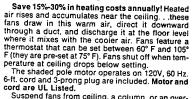
Diage	Max.	RPM ·	Max.		
Dia.	Amps	Range	CFM	No. NET EA	СН
42"	0.6	80-240	5000	1913K6 \$196	43
52"	1.0	50-190	7600	1913K3 272	71
				Z/Z	***



- E	Section		THE RESERVE OF THE PARTY AND RESERVE
The state of	terania in em an atura in in	The state of the state of the state of	CEILING FAN INSTALLATION KIT Con
to decide	vicini de la composició	s oversize faceplate.	31/2" threaded steel rods, two U-shaped m
Voits	Max. Amps	No. NET FACH	one electrical box, one hammer bar, plus
115	2.5	2042K74 \$15.79	and nuts.
115	6.0	2042K75 19 64	Kits are UL Listed for fans/fixtures up to 3
115		2042K78 57 00	mounted on box ears, fans with narrow bra
277	3.0	2042K78 22.62	bolts, and fixtures up to 100 pounds on bo
2//	8.0	2042K79 45.57	No. 2042K77NET EAC

CEILING FAN INSTALLATION KIT - Contains two 31/2" threaded steel rods, two U-shaped metal feet, one electrical box, one hammer bar, plus spacers

Heat Recovery Ceiling Fans



Suspend fans from ceiling, a column, or an over-head structure. One 45-ft. flexible duct is included. Duct, housing, and fan blade are flame retardant.

Effective Area	Air Flow		
Square Feet		No.	NET EACH
2500	400	1918K	13 \$129 18
2000	250	1918K	14 111 36
Extra Duct-45-1	oot length	1918K	51 31.50

Vortex Action Portable Air Circulation Fans



Get all the air movement benefits of a ceiling fan in these floor fans, plus an added adventage—they're portable! Fans are fully assembled and feature vortex action which gently and quietly moves air. Great for high velocity air movement in the summer and soothing. low velocity destratification in the winter. Motors operate on 115V, 85 watts. They feature an infinitely variable speed control from 200 to 1500 rpm. Fans maintain stream of air for up to 75 feet to provide total room air circulation.

vide total room air circulation

These polypropylene fans have a steel strut base and a graystone color. Fans meet or exceed UL and OSHA standards.

	The second section of the second seco	ouius,
Description	Ht. \times Wd. \times Lg.	No. NET EACH
Short Stand	19.5" × 15.25" × 15.25"	1946K89 \$111.69
Long Stand	23.0" × 18.50" × 18.50"	.1946K91 132.85

McMASTER-CARR

Universal Re

Replace any style of propeller—in virtually a applications. Great for roof-top unit heaters, cordensing units, walk-in refrigeration units, plus pedestal and ventilating fans.

The propellers have a steel center (known as RATED AT 1550 RPM

Blade				CF	M at				
	u.		Pitch	ur.	SP.	N.	п.	NE	T EAC
- INCE		ne	PRO	₽ ₽ ₹	~ H >		4EE	AIH	31 T L I
- 04	ላ ባ3		23°	- 5	90	20	90K	119	S8.t
400	0.05		230	- 10	40	20	wĸ	129	8.3
4 40	റ റദ		230	- 10	IRO -	20	90K	139	1 U.1
4.04	ለ ለፍ		23°	17	'80	20	90K	149	12
400	A 11		23°	23	.30	20	90K	159	14.
202	0.25		.23°	31	30	20	90K	169	16.:
24"	0.33		.18°	45	530	20	90K	189	22.7
FOUR.	RI AI	DE S	PAGE	PELLI	ERS:	–FR	EE /	MR S	TYLE
10"	0.04		.23°	6	:. 00	20	90K	199	\$8.
12"	വരം		.23°	10	170	20	190K	219 .	9.4
100	0.12		.23°	25	560	20	190K	249	18.2
200	.0.28		.23°	34	140	20	90K	259 .	19.:
24000	.0.36		. 18°	50	030	20	90K	279 .	24.:
FOUR-	BLA	DE P	ROP	ELLE	RS-	-COI	JDE I	NSEF	ł STYI
14"	.0.19		.23°	9	920	20	190K	329●	\$11.
• Rate	d at	1625	RP	Mat (0.30	SP.			
-4"							- -		

Galvanized Steel an Semi-Stainless Steel Pro

Corrosion-resistant blades are ideal for ai units, roof-top ventilators, plus more. Semi-stair pellers have 304 stainless steel blades and rivets plated steel hub plate. Blade pitch is 27°. Adapt pr bore size by using the appropriate bushing sold
CFM BHP CFM BHP

Na.	RPM	0" SP	O" SP	0.3" SP	0.3" SP R
4"	.,1140	6,790.	0.62	5,520	0.731
6"	.1140	9,020.	1.10	7,800	1.221
8"	1000	9,900.	1.07	8,310	1.211
٠	1000	11,070.	1.27	9,350	1.531
6"	840.	16,700.	2.00	14,160	2.27
					3.07
8"	500.	23,750.	1.86	16,900	2.18
극학			SPLIT-T	APERED	ZINC-PLA
Bore	No.	o. NET	EACH	Bore	No.
					19055
۲°	19	055K102	5.88	1*	19055
W	19	055K102	5.88	11/1"	19055

Cast Aluminum Prop

High-grade aluminum alloy propellers are cathat blades can't fly apart, even in around-the-pellers are precision balanced for smooth-runnir ent for use on all kinds of fans.

All propellers run clockwise facing the shaft er

have two set screws. Heavy-duty models have st Table below indicates expected performance other bore sizes available for heavy-duty mo 11/4" bore. Specify 1910K999, bore size, and bla

lade	1725 RPM Hp CFM	1140 RP
ia.	Hp CFM	Ho C
2" "	1,255	1/-
4,	1/- 1,200	/40
5°	½0 1,800 ½10 2,800	/30
o• ······	/10 2,800	1/20
<u></u>	1/8 3,100	
8	1/8 3,900	
U	1/4 4 840	1/4 1
٠	1/5 8 165	1/4 6
U	1 14500	14 1/
O'	3 30,000	414 4
WO-BLA	DE MEDIUM-DUTY PI	
8,0.00	.DE MEDIUM-DUTY PI	HOPELLERS
or	···· /8 ····· 2,800 ····	/8
40	1/6 3,900	
	1/4 4 050	1/-
**********	. 1/2 0 500	1/4 1
	114,100	1/2 1
liade	1750 RPM Hp CFN	
lia.	1750 RFM	
WOLDLA	Hp CFN	۴ H
K* O-D_A	DE HEAVY-DUTY PRO	OPELLERS
······	1½18.00	001
	5	003
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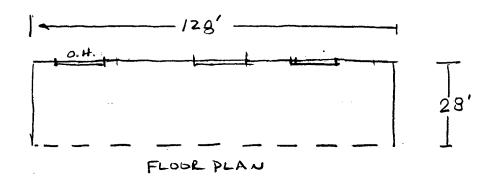
·	JOB WSMR ES OS STUDY	井1110-000
E M A ENGINEERO INO	SHEET NO.) of
E M C ENGINEERS, INC. Denver • Colorado Springs • Atlanta • West Germany	CALCULATED BY	DATE 3/18/92
,		_ DATE
BUX P21140 TEMP. TEST FACILITY	SCALE	

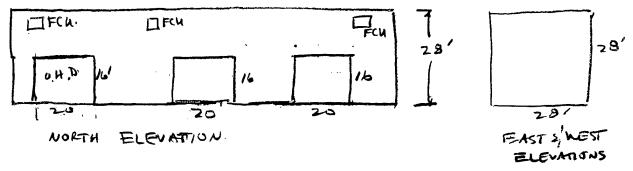
ECO: INSTALL FANS TO DESTRATIFY A HIGHBAY ENTRANCE AREA.

CURLENT STRUCTUM: Temperature stratification exists. Fancoil

units heat the space, but homogoligh in the bay (22' above

the floor).





POOF AREA = 128 x 28 = 3,584 0.H DOOL AREA = 3 x 20 x 16 = 960 SF EXT. WALLAREA = 2 x 28 x 28 + 128 x 28 - 960 = 4,192 SF.

ROOF RVALUE = 25 ; U = 0.04 } From TRACE 600 BASELINE MODEL.
WALL RVALUE = 2.96 ; U = 0.336)

O.H. DOOR (2/2"STEEL) U= 0.60 (ASHRAE F22.12, TABLE 6)

E	M	C	ENG	AIE	EE	RS,	INC.

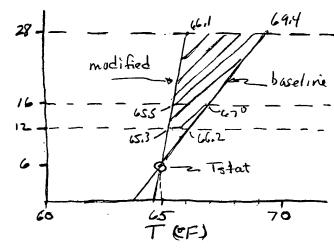
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SHEET NO.	2 of 7
CALCULATED BY	DATE
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TEMPERATURE PROFILES!

Reduction in heat conductions occurs above 12 leight

h(H)



METHOD.

TEMPERATURE PROFILES FOR ALL SURFACES ABOVE 12FT.

¿ (BTU/Yr) | modified = UA x # modified heating degree hours.

will be calculated;

There | baseline | Awx Ave wall Temp + Aroof x roof temp +

Adams x Ave door. temp] (Aw+Ar+An)

Aw = (2x28x16) + (128x16) - (3x20x4) = 27045F.

AD = 3x20x4 = 2405F.

Ar = 128x28 = 3,584 SF.

TOTA: AREA = 6,528 SF

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JOB	
SHEET NO.	3 of 7
CALCULATED BY	DATE
CHECKED BY	DATE
SCALE.	

= 68.6°F

= 46.0°F.

From TMJ-785 FOR FT. BUSS, CALCULATE ANNUAL HEATING DEGREE HOURS FOR THESE 2 BASE TEMPS; (See next page)

Baseline # HD hr = 74,703 Molified # HD hr = 65,040.

calculate UA = LI-A++Uw Aw+UD AD = .04x 35B4 +.336 x 2704+.60 x 240 = 1196 BTU/OF-M

g | baceline = 1196 x 74,703 = 96,8 MBTh/4r

7 modified = 1196x 65,040 = 84,3 MBTU/4r

Electrial source energy savings = 96.8-84.3 = 12.8 MBT4/yr. = 12.8 MBtu/.003413 MBtu/km#

= 12.8 MBtu/.003413 MBtu/kwl = 3,737 KWh/Yr.

E M C ENGINEERS, INC.

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JOB WSMR ESUS STUDY	土1110-000
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TM 5-185 PG. 3-372 2/3-373

TOTAL OBSERVATION (HPS)									
Temp	UCT	Nov	DEC	JAN	FEB	MAR	- tow	1 76 K	BIN.
Range							(Ru)		
65/69	119	68	19	21	39	8-8	354	67.5	14
60/64	122	8-8	54	56	67	109	496	62.5	13
5 \$ \ 59	110	99	79	77	85	117	567	67.5	15
50/54	71	, 07	98	104	101	104	585	525	11
45/49	35	109	114	113	101	24	566	47.5	10
40/44	13	95	114	113	87	63	485	42.5	4
35/39	1	64	109	103	73	43	393	37.5	8
30/34		30	90	75	50	20	265	32.5	7
25/29		13	43	43	27	9	135	27.5	6
20/24		2	14	21	12	ì	50	22.5	5
15/19			3	8	6		17	17.5	4
,			1	4	İ		6	12.5	3
10/14	•			1			1	7.5	2
0/4				1			}	2,5	1
•									,

heating degree hours = XG 8.6-Toin) xti = 74,703 deg hus.
Dareline

therting degree hours = \(\frac{13}{66.0} - \tag{1} \) \(\tau \)

BUILDING U-VALUES - ALTERNATIVE 1 (BASELINE) BUILDING 21140

5 of 7



	Room U-Values									Room	Room		
						(Btu	/hr/sqf	t/F)				Mass	Capac.
Room					Summr	Wintr		Summr	Wintr			(1b/	(Btu/
Number	Desc	ription	Part.	ExFlr	Skylt	Skylt	Root	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	ROOM	1	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.336	0.000	211.1	42.78
Zone	1	Total/Ave.	0.000	0.750	0.000	0.000	0.049	0.000	0.000	0.336	0.000	211.1	42.78
3	ROOM	3	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.221	0.000	155.7	31.83
Zone	3	Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.221	0.000	155.7	31.83
System	1	Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.269	0.000	172.8	35.20
1	ROOM	1	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.336	0.000	211.1	42.78
Zone	1	Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.336	0.000	211.1	42.78
3	ROOM	3	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.221	0.000	155.7	31.83
Zone	3	Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.221	0.000	155.7	31.83
System	2	Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.269	0.000	172.8	35.20
2	ROOM	2	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	35.4	7.07
Zone	2	Total/Ave.	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	35.4	7.07
System	3	Total/Ave.	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	35.4	7.07
Buildin	g		0.047	0.750	0.000	0.000	0.040	0.000	0.000	0.269	0.000	170.8	34.80

BUILDING AREAS - ALTERNATIVE 1 BASELINE BUILDING 21140

------ BUILDING AREAS

			Numbe	er of	Floor Area/Dupl	Total Floor	Partition	Exposed Floor	Skylight	Skl	Net Roof	Window	Win	Net Wall
Room			Dup1:	lcate	Room	Area	Area	Area	Area	/Rf	Area	Area	/Wl	Area
Number	Desci	ription	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
/	/													
1	ROOM	1	1	1	3,584	3,584	0	184	0	0	3,584	0	0	5,125
Zone	1	Total/Ave.				3,584	0	184	0	0	3,584	0	0	5,125
3	ROOM	3	1	1	8,063	8,063	0	280	0	0	8,063	0	0	7,165
Zone	3	Total/Ave.				8,063	0	280	0	0	8,063	0	0	7,165
System	1	Total/Ave.				11,647	0	464	0	0	11,647	0	0	12,290
1	ROOM	1	1	1	3,584	3,584	0	184	0	0	3,584	0	0	5,125
Zone	1	Total/Ave.				3,584	0	184	0	0	3,584	0	0	5,125
3	ROOM	3	1	1	8,063	8,063	0	280	0	0	8,063	0	0	7,165
Zone	3	Total/Ave.				8,063	0	280	0	0	8,063	0	0	7,165
System	2	Total/Ave.				11,647	0	464	0	0	11,647	0	0	12,290
2	ROOM	2	1	1	336	336	592	0	0	0	0	0	0	0
Zone	2	Total/Ave.				336	592	0	0	0	0	0	0	0
System	3	Total/Ave.				336	592	0	0	0	0	0	0	
Buildin	g					23,630	592	928	0	0	23,294	0	0	24

FORT BLISS/BIGGS AAF TEXAS LAT 31 51N LONG 106 23W ELEV 3947 FT

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		11/2.	Mean Speed	Anots	7 0 1 10 10	£0805	25000	ით∨იი	121089	18000	യതയത
	ATTREE MAN	स्तर क्ष≎	Pylg 5% Wind	ā	22222	32222 2 2	ZZ33Z ZZ ZZ ZZ	32222 2 2	ZZZZZ	N NNS N NNS N N N N N N N N N N N N N N	ZZZZ
		S Bulb	97	5-	33232	90000 90000 90000	38 31 31 19	22233 21483	92108 92108	22002 22002 2002	329
		ă	39%	3.	85 10 30 20 28 28 28 28 28 28 28 28 28 28 28 28 28	31831	34 20 26 15	20000	20 17 31 31	18 18 25 27	32 32 29 29
		3.7	Elev	feel	4 1981 1987 1988 1988	1386 1386 1400 650 651	19 481 495 1026 1789	884 40 3918 3947 923	1015 760 900 537 7	558 1877 35 901 96	690 50 670 24
	96	_	ا مو	-	₹24468 80077	26 57 26 30	17 51 58 55 51	33 23 43 43	4004 483 483 483 483 483 483 483 483 483 48	213949	37 37 04
		LOCATION	tong	•	106 97 98 98	97 98 97 97	97 96 100 99	100 95 106 106	998 97 94	100 99 99 95	998
		[[at		842122 62281	54 48 47 46	224 224 252 253	52 337 53 53 53	200 200 180 180	254 17 21 58 58	233 733 733
				-	30 23 23 23 23	232 232 27	32222	31133	23231 23231 23231	220212	230 230
Alery	Segue P										
					lens (Cun) Beaumont Army Hospital Beeville/Chase Field NAS Bergstrom AFB/Austin Brooke Army Medical Center	ţ	e1d		AAF	je 1 o	
					piti eld tin al (rownsville IAP rownwood amp Bullis arswell AFB/Fort Worth orpus Christi IAP	s y Fi	s ton IAF	Gray	Station FB/San Angelo	nio
	~				Hos Fi Aus dic	P Ort IAF	NAS eld isley ene	Hous Js A AAF	- t.c	San	into
2.5					rmy nase NFB/	E IAI	sti Fi Hen bil	AFS FB/I Big(ober usto s IAP	Sti	an A
in the second	¥ ,				t Al e/Cr om A Army	ille od ilis I AFI	Chri Love IAS/ IAP B/A	ISS IAP IAP SS/I	Hood/Robert Sam Houston Wolters Worth IAP ston	ANG OW: / D P IAP	B/Si le N AFE ANG
			Statum		IN IN IN IN IN IN IN IN IN IN IN IN IN I	rownsvill rownwood amp Bulli arswell A orpus Chr	us (as/1 as n Rio s AF	e Pž ngtc aso Bli Hoo	Hood/Robe Sam Houst Wolters Worth IAF	ell nge nge on	AF ivil and rte
		STATE			Beaumor Beevill Bergstr Brooke Brooks	Brownsville Brownwood Camp Bullis Carswell AF Corpus Chri	Corpus Christi M Dallas/Love Fiel Dallas NAS/Hensl Del Rio IAP Dyess AFB/Abilen	Eagle Pass AFS Ellington AFB/Houston El Paso IAP Fort Bliss/Biggs AAF Fort Hood/Hood AAF	ort ort ort alve	Garland ANG Goodfellow A Harlingen Hondo MAP Houston IAP	Kelly AFB/San Antonio Kingsville NAS Lackland AFB La Porte ANG Station
		ıs .				മമാധാ	D15-13	ասա <u>ւ</u> նն }	6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	o o i i i i	\$5,7,7
						• ,	1710-13	T			

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PAGE 1

ESOS STUDY AT WSMR - BUILDING 21140
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
NEW BLDG AUDIT: ALT 1-BSLN, ALT2-ECO

Weather File Code:

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Location:

Latitude: 31.0 (deg)

Longitude: 106.0 (deg)

Time Zone: 6

Elevation: 3,918 (ft)

Barometric Pressure: 25.8 (in. Hg)

ELPASO.W

Summer Clearness Number: 1.00
Winter Clearness Number: 1.00
Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:12:46 2/ 6/92
Dataset Name: 21140 .TM

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

System 1 Block UH - UNIT HEATERS (RMT MCR)

Peaked a	t Time ==>	•	Mo/Hr: 0)/ 0				* Mo,	Hr: 0	/ 0 *		Mo/Hr: 13	/ 1		
Outside i	Air ==>	QA.	DB/WB/HR:	0/ 0/ 0.0	ס			* Ož	ADB:	0 *		OADB: 2	4		
								*		*					
		Space	Ret. Air	Ret. Air	N	et P	ercnt	* S	pace	Percnt *	Space P	eak Coil E	eak	Perc	nt
	Se	ns.+Lat.	Sensible	Latent	Tot	al O	f Tot	* Sens:	ible	Of Tot *	Space S	ens Tot S	ens	of To	ot
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btu	h)	(%)	* (B1	uh)	(\$) *	(Bt	uh) (Bt	uh)	('	a)
Skylit	e Solr	0	0			0	0.00	*	0	0.00 *		0	0	0.0	00
Skylit	e Cond	0	0			0	0.00	*	0	0.00 *		0	0	0.0	00
Roof Co	ond	0	0			0	0.00	*	0	0.00 *	-20,	499 ~20,	499	9.0	23
Glass :	Solar	0	0			0	0.00	*	0	0.00 *		0	0	0.0	00
Glass	Cond	0	0			0	0.00	*	0	0.00 *		0	0	0.0	00
Wall Co	ond	0	0			0	0.00	*	0	0.00 *	-145,	467 -145,	467	64.	36
Partit:	ion	0				0	0.00	*	0	0.00 *		0 .	0	0.0	00
Expose	d Floor	0				0	0.00	*	0	0.00 *	-15,	312 -15,	312	6.	74
Infilt:	ration	0				0	0.00	*	0	0.00 *	-45,	798 -45,	798	20.	17
Sub To	tal==>	0	0			0	0.00	*	0	0.00 *	-227,	076 -227,	076	100.	00
Internal	Loads							*		*					
Lights		0	0			0	0.00	*	0	0.00 *		0	0	0.1	00
People		0				0	0.00	*	0	0.00 *		0	0	0.0	00
Misc		0	o	0		0	0.00	*	0	0.00 *		0	0	0.0	00
Sub To	tal==>	0	o	0		0	0.00	*	0	0.00 *		0	0	0.0	00
Ceiling 1	Load	0	0			0	0.00	*	0	0.00 *		0	0	0.0	00
Outside A	Air	0	0	0		0	0.00	*	0	0.00 *		0	0	0.9	
Sup. Fan	Heat					0	0.00	*		0.00 *			. 0	٥.	
Ret. Fan	Heat		0			0	0.00	*		0.00 *			0	0.6	00
Duct Hear	t Pkup		0			0	0.00	*		0.00 *			0	0.6	00
OV/UNDR	Sizing	0				0	0.00	*	0	0.00 *		0	0	0.0	30
Exhaust 1	Heat		0	0		0	0.00	*		0.00 *			0	0.0	00
Terminal	Bypass		0	0		0	0.00	*		0.00 *			0	0.0	00
								*		*					
Grand To	tal==>	0	0	0		0	0.00	*	0	0.00 *	-227,	076 -227,	076	100.	00
				LING COIL S								AREAS			
		apacity	•	Coil Airfl		_	DB/WB/B		-	/WB/HR	Gross To		s (sf) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	•	Deg F		-	Deg F	Grains	Floor	11,647			
Main Clg	0.0	0.0	0.0	0	0.0	0.0			0.0	0.0	Part	0			
Aux Clg	0.0	0.0	0.0	0	0.0	0.0			0.0	0.0	ExFlr	464		_	
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	٥.	.0 0.0	0.0	0.0	Roof	11,647		0	0
Totals	0.0	0.0									Wall	12,290		0	0
	*****		ECTION			3 7 7 7 7 7	ove / -4	(m)		NGINEERING	CHECKO	TEMPERA	and the second	/ TO 3	
		Coil A					ows (C)	Heating		% OA	0.0	Туре	Clg	Ht	
				Lvg	Type Vent	CO	0	neacing 0	-	Cfm/Sqft	0.00	SADB	0.0		-
Main Htg	(Mbh) -372.0	•		Deg F 90.6	Infil		0	1,087	•	Cfm/Sqrt Cfm/Ton	0.00	Plenum	0.0		
•	-3/2.0		0 0.0	0.0	Supply		0	10,500	-	Sqft/Ton	0.00	Return	0.0		
Aux Htg	0.0		0 0.0	0.0	Mincfm		0	10,300	_	Sqrt/1011 Btuh/Sqft		Ret/QA	0.0		
Preheat	0.0		0 0.0	0.0	Return		0	10,500	•	People	0.00	Runarnd	0.0		
Reheat Humidif	0.0		0 0.0	0.0	Exhaust		0	10,500		* OA	0.0	Fn MtrTD	0.0		.0
Opt Vent	0.0		0 0.0	0.0	Rm Exh		0	0		Cfm/SqFt		Fn BldTD	0.0		.0
Total	-372.0		0.0	0.0	Auxil		0	0		Btuh/SqFt		Fn Frict	0.0		. o . o
2002	3121	-					•	·	****	, 222				7	

System	2	Peak	SZ	- SINGLE	zone (EV)	160016	45)	Pml	+11/5	, é				
*****	******	*****	COOLING COIL	PEAK ****	******	******	***	**** CLG 8	SPACE :	PEAK ****	****** HE	EATING COIL	PEAK *	****
Peaked a				8/13			*	Mo/I		/16	•		0/ 0	
Outside !	Air ==>	OA	DB/WB/HR:	94/ 64/ 56.	0		*		DB: 9		t	OADB:	0	
							*			1	•		•	
		Space	Ret. Air	Ret. Air	Net	Percnt	*	Spa	ace	Percnt	Space I	eak Coil I	eak	Percnt
		Sens.+Lat.	Sensible	Latent	Total	Of Tot	*	Sensil		Of Tot	=			Of Tot
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Bti		(%)	•		tuh)	(%)
Skylit	e Solr	0	0		0	0.00	*	·	0	0.00	•	o `	o	0.00
Skylit	e Cond	0	o		0	0.00	*		0	0.00	•	0	0	0.00
Roof Co	ond	6,056	o		6,056	0.34	*	17,7	703	6.54		0	0	0.00
Glass :	Solar	0	0		0	0.00		•	0	0.00	•	0	0	0.00
Glass	Cond	0	0		0		*		0	0.00	•	0	0	0.00
Wall Co	ond	29,084	o		29,084	1.61	*	55,1	L48	20.38	•	0	٥	0.00
Partit:	ion	0			0	0.00	*	•	0	0.00	•	0	0	0.00
Expose	d Floor	0			0	0.00			0	0.00		0	0	0.00
Infilt:	ration	0			0		*		0	0.00		0	0	0.00
Sub To	tal==>	35,141	o		35,141	1.95	*	72,8		26.92		0	0	0.00
Internal	Loads	•					*	,			•	·	·	0.00
Lights		49,689	0		49,689	2.76	*	49,6	589	18.36	•	0	0	0.00
People		5,360			5,360	0.30	*	2,7	760	1.02	•	0	0	0.00
Misc		137,595	0	0	137,595	7.64	*	137,5		50.85	•	0	0	0.00
Sub To	tal==>	192,644	0	o	192,644	10.69	*	190,0)44	70.23	•	0	0	0.00
Ceiling 1	Load	0	0		0	0.00	*		0	0.00	r	0	0	0.00
Outside 1	Air	o	0	0	1,432,192	79.49	*		0	0.00	•	0	0	0.00
Sup. Fan	Heat				133,973	7.44	*			0.00			0	0.00
Ret. Fan	Heat		0		. 0		*			0.00			0	0.00
Duct Heat	t Pkup		0		0	0.00	*			0.00	t		0	0.00
OV/UNDR S	Sizing	7,696			7,696		*	7,6	96	2.84	.	0	0	0.00
Exhaust E	leat		0	0	. 0	0.00	×	•		0.00	ŧ	_	٥	0.00
Terminal	Вуравв		0	0	0	0.00	*			0.00	:		0	0.00
							*				:			
Grand To	tal==>	235,480	0	0	1,801,645	100.00	*	270,5	91	100.00	į	0	0	0.00
			COO	LING COIL SI	ELECTION						*	AREAS		
	Total	Capacity	Sens Cap.	Coil Airfl	Enteri	ig DB/WB/	HR	Leavi	ing DB.	/WB/HR	Gross To	tal Glas	ss (sf) (%)
	(Tons)		(Mbh)	(cfm)	Deg F Deg	; F Grai	ns.	Deg F I	eg F	Grains	Floor	11,647		
Main Clg	150.1	•	1,801.0	94,200		1.0 56	.0	73.5	57.5	56.5	Part	0		
Aux Clg	0.0		0.0	0			0.0	0.0	0.0	0.0	ExFlr	464		
Opt Vent	0.0		0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	11,647		0 0
Totals	150.1	1,801.6									Wall	12,290		0 0
	UPATT	NC COTT CET	ECTION											
	Capaci			Lvg	Type	Cooling		Heating			CHECKS	TEMPERA		
	(Mbh	-		Deg F	Vent	94,200		oeacing 0	_	% OA Cfm/Sqft	100.0	Туре	Clg	Htg
Main Htg	-0	•	0 0.0	0.0	Infil	0		0	_	Cfm/Sqrc	8.09 627.43	SADB	75.0	
Aux Htg		.0	0 0.0	0.0	Supply	94,200		0	_	Sqft/Ton		Plenum Return	78.0 78.0	
Preheat	-0		200 24.0	73.5	Mincfm	0		0		Btuh/Sqf1		Ret/OA	93.9	
Reheat		.0	0 0.0		Return	0		0	_	People	. 134.69	Runarnd	78.0	
Humidif		.0	0 0.0		Exhaust	0		0		% OA	0.0			
Opt Vent		.0	0 0.0	0.0	Rm Exh	94,200		0	_	Cfm/SqFt		Fn MtrTD Fn BldTD	0.4	
Total		.0	,		Auxil	0		0		Btuh/SqFt			0.3	
-	_					J		•	arg	neam, ndt i	. 0.00	Fn Frict	0.8	0.0

PAGE

Peak PTAC - PACKAGED TERMINAL AIR COND. System 3

System	3	Peak	PTAC	- PACKAGEI	TERMINAL	AIR CON	٠.							
					******	*****					****** HEATI			*****
Peaked at				5/14	_		*			5/14 * 97 *		-	/ 0	
Outside /	Air ==>	OA	DB/WB/HR:	97/ 61/ 35.0)		*	O.	ADB: 9	97 *		OADB:	0	
					••						Sanaa Daab	0-41 D		D
		Space		Ret. Air		Percni		_	pace	Percnt *	Space Peak			Percnt Of Tot
		Sens.+Lat.	Sensible	Latent	Total			Sensi		Of Tot *	Space Sens			
Envelope		(Btuh)	(Btuh)	(Btuh)	(Btuh)		•	78.)	tuh)	V - 7	(Btuh) O	(Bt	.цп)	(%) 0.00
Skylite		0	0			0.00			0		_			
Skylite		0	0			0.00			0	0.00 *	0		0	0.00
Roof Co		0	0			0.00			0	0.00 *	0		0	0.00
Glass S		0	0			0.00			0	0.00 *	0		0	0.00
Glass (0	0			0.00			0	0.00 *	0		0	0.00
Wall Co		0	0			0.00			0	0.00 *	0		0	0.00
Partit:	ion	0				0.00			0	0.00 *	0		0	0.00
Exposed	d Floor	0			(0.00	* 0		0	0.00 *	0		0	0.00
Infilt	ration	0			(0.00	* 0		0	0.00 *	0		0	0.00
Sub Tot	tal==>	0	0		(0.00	* 0		0	0.00 *	0		0	0.00
Internal	Loads						*			*				
Lights		1,720	0		1,720			1,	,720	7.78 *	0		0	0.00
People		1,340			1,340				690	3.12 *	0		0	0.00
Misc		23,891	0	0	23,89				,891	108.01 *	0		0	0.00
Sub To	tal==>	26,951	0	0	26,95			26,	,301	118.91 *	0		0	0.00
Ceiling 1	Load	0	. 0		(0.0	* 0		0	0.00 *			0	0.00
Outside A	Air	0	0	0	(0.0			0	0.00 *	0		0	0.00
Sup. Fan	Heat				(0.0	* 0			0.00 *			0	O _i
Ret. Fan	Heat		0		(0.0	* 0			0.00 *			0	0.65
Duct Heat	t Pkup		0		(0.0	* 0			0.00 *			0	0.00
OV/UNDR S	Sizing	-4,183			-4,18	3 -18.3	7 *	-4	,183	-18.91 *	0		0	0.00
Exhaust I	Heat		0	0	•	0.0				0.00 *			0	0.00
Terminal	Bypass		0	0	•	0.0	•			0.00 *			0	0.00
Grand To	tal==>	22,768	0	0	22,76	8 100.0	* 0	22	,118	100.00 *	0		0	0.00
			coo	LING COIL SI	ELECTION							areas		
	Total	Capacity	Sens Cap.	Coil Airfl	Enter	ing DB/W	B/HR	Leav	ving D	B/WB/HR	Gross Total	Glas	8 (8f)) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)		-	ains	Deg F	Deg F	Grains	Floor	336		
Main Clg	2.9	35.0	34.0	1,100	-	-	58.1	54.0	45.4	38.6	Part	592		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	0		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	0		0 0
Totals	2.9	35.0									Wall	0		0 0
	HEATI	NG COIL SEL	ECTION		А	IRFLOWS	(cfm))	:	ENGINEERING	CHECKS	TEMPERA	TURES	(F)
	Capaci	ty Coil A	irfl Ent	Lvg	Туре	Coolin	g	Heating	Cl	g % OA	0.0	Туре	Clg	Ħtg
	(Mbh) (cf	m) Deg F	Deg F	Vent		0	0	Cl	g Cfm/Sqft	3.27	SADB	54.0	0.0
Main Htg	-0	. 0	0 0.0	0.0	Infil		0	0	Cl	g Cfm/Ton	376.71	Plenum	75.0	0.0
Aux Htg	0	. 0	0 0.0	0.0	Supply	1,10	0	0	Cl	g Sqft/Ton	115.07	Return	75.0	0.0
Preheat	-0	.0 1,	100 0.0	54.0	Mincfm		0	0	Cl	g Btuh/Sqft	104.29	Ret/OA	75.0	0.0
Reheat	0	.0	0 0.0	0.0	Return	1,10	0	0	No	. People	2	Runarnd	75.0	0.0
Humidif	0	.0	0 0.0	0.0	Exhaust		0	0	Ħt	g % OA	0.0	Fn MtrTD	0.0	0.0
Opt Vent	0	. 0	0 0.0	0.0	Rm Exh		0	0	Ht	g Cfm/SqFt	0.00	Fn BldTD	0.0	0.0
Total	0	.0			Auxil		0	0	Ht	g Btuh/SqFt	0.00	Fn Frict	0.0	0.0

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 21140

----- BUILDING U-VALUES------

					Room	Room						
					(Btu	/hr/sqf	t/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	ROOM 1	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.336	0.000	211.1	42.78
Zone	<pre>1 Total/Ave.</pre>	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.336	0.000	211.1	42.78
3	ROOM 3	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.221	0.000	155.7	31.83
Zone	3 Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.221	0.000	155.7	31.83
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.269	0.000	172.8	35.20
1	ROOM 1	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.336	0.000	211.1	42.78
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.336	0.000	211.1	42.78
3	ROOM 3	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.221	0.000	155.7	31.83
Zone	3 Total/Ave.	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.221	0.000	155.7	31.83
System	<pre>2 Total/Ave.</pre>	0.000	0.750	0.000	0.000	0.040	0.000	0.000	0.269	0.000	172.8	35.20
2	ROOM 2	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	35.4	7.07
Zone	2 Total/Ave.	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	35.4	7.07
System	3 Total/Ave.	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	35.4	7.07
Buildin	g	0.047	0.750	0.000	0.000	0.040	0.000	0.000	0.269	0.000	170.8	34.80

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 21140

BUILDING AREAS

					Floor	Total		Exposed						
			Numbe	er of	Area/Dupl	Floor	Partition	Floor	Skylight	Skl	Net Roof	Window	Win	Net Wall
Room			Dupl	lcate	Room	Area	Area	Area	Area	/Rf	Area	Area	/W1	Area
Number	Descr	ription	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	ROOM	1	1	1	3,584	3,584	0	184	0	0	3,584	o	0	5,125
Zone	1	Total/Ave.				3,584	0	184	0	0	3,584	0	0	5,125
3	ROOM	3	1	1	8,063	8,063	0	280	0	0	8,063	O	0	7,165
Zone	3	Total/Ave.				8,063	0	280	0	0	8,063	0	0	7,165
System	1	Total/Ave.				11,647	0	464	0	0	11,647	0	0	12,290
1	ROOM	1	1	1	3,584	3,584	0	184	0	0	3,584	0	0	5,125
Zone	1	Total/Ave.				3,584	0	184	0	0	3,584	0	0	5,125
3	ROOM	3	. 1	1	8,063	8,063	0	280	, 0	0	8,063	0	0	7,165
Zone	3	Total/Ave.				8,063	0	280	0	0	8,063	0	0	7,165
System	2	Total/Ave.				11,647	0	464	0	0	11,647	0	0	12,290
2	ROOM	2	1	1	336	336	592	0	0	0	0	0	0	0
Zone	2	Total/Ave.				336	592	0	0	0	0	0	0	0
System	3	Total/Ave.				336	592	0	0	0	0	0	0	0
Buildin	ıg					23,630	592	928	0	0	23,294	0	0	24,579

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

System Totals

Percent	Cooling Load		Heatin	ng Load		Cooling	Airflow		Reating	Airflow		
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	7.7	100	8,760	-18,600	17	604	5,290.0	0	0	0.0	0	0
5 - 10	15.3	0	0	-37,200	35	1,281	10,580.0	0	0	0.0	0	0
10 - 15	23.0	0	0	-55,800	45	1,630	15,870.0	57	5,008	0.0	0	0
15 - 20	30.6	0	0	-74,400	4	144	21,160.0	0	0	0.0	0	0
20 - 25	38.3	0	0	-93,000	0	0	26,450.0	0	0	0.0	0	0
25 - 30	45.9	0	0	-111,600	0	0	31,740.0	0	0	0.0	0	0
30 - 35	53.6	0	0	-130,200	0	0	37,030.0	0	0	0.0	0	0
35 - 40	61.2	0	0	-148,800	0	0	42,320.0	0	0	0.0	0	0
40 - 45	68.9	0	0	-167,400	0	0	47,610.0	0	28	0.0	0	0
45 - 50	76.5	0	0	-186,000	0	0	52,900.0	0	0	0.0	0	0
50 - 55	84.2	0	0	-204,600	0	0	58,190.0	0	0	0.0	0	0
55 - 60	91.8	0	0	-223,200	0	0	63,480.0	0	0	0.0	0	0
60 - 65	99.5	0	0	-241,800	0	0	68,770.0	0	0	0.0	0	0
65 - 70	107.1	0	0	-260,400	0	0	74,060.0	0	0	0.0	0	0
70 - 75	114.8	0	0	-279,000	0	0	79,350.0	20	1,736	0.0	0	0
75 - 80	122.4	0	0	-297,600	0	0	84,640.0	0	.0	0.0	0	0
80 - 85	130.1	0	0	-316,200	0	0	89,930.0	0	0	0.0	0	0
85 - 90	137.8	0	0	-334,800	0	0	95,220.0	0	0	0.0	0	0
90 - 95	145.4	0	0	-353,400	0	0	100,510.0	G	0	0.0	0	0
95 - 100	153.1	0	0	-372,000	0	0	105,800.0	23	1,988	0.0	0	0
Hours Off	0.0	0	0	0	0	5,101	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

	ELEC	DEMAND
	On Peak	On Peak
Month	(kWh)	(kW)
Jan	17,709	47
Feb	15,162	46
March	11,849	38
April	25,867	105
May	49,426	140
June	71,784	140
July	83,964	140
Aug	77,728	140
Sept	52,065	140
Oct	26,180	105
Nov	11,576	40
Dec	15,376	44
Total	458,686	140

Building Energy Consumption =
Source Energy Consumption =

66,250 (Btu/Sq Ft/Year) 66,250 (Btu/Sq Ft/Year) Floor Area =

23,630 (Sq Ft)

Monthly KW = 1,125

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

 UTILITY	PEAK	C H E C K S U M S

Utility ELECTRIC DEMAND

Peak Value 140.1 (kW)

Yearly Time of Peak 16 (hr) 5 (mo)

Hour 16 Month 5		
Eqp.	Utility	Percnt
Ref. Equipment	Demand	Of Tot
Num. Code Name	Equipment Description (kW)	(%)
Cooling Equipment		
1 DIREVAP	DIRECT EVAP COOLING ONLY 3.7	2.66
Sub Total	3.7	2.66
Sub Total	0.0	0.00
Air Moving Equipment		
2	SUMMATION OF FAN ELECTRICAL DEMAND 106.7	76.19
Sub Total	106.7	76.19
Sub Total	0.0	0.00
Miscellaneous		
Lights	29.8	21.14
Base Utilities	. 0.0	0.00
Misc Equipment	0.0	0.00
Sub Total	29.6	21.14
Grand Total	140.1	100.00

		LOCATION: White			REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				RGY EFFICIENT LIGHTI	NG		FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/11/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IN۱	VESTMENT						
		CONSTRUCTION	COST	=			\$4,259	
		SIOH COST		(5.5% of 1A) =			\$234	
	C.	DESIGN COST		(6.0% of 1A) =			\$256	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$4,748	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			 >	\$4,748
							_	V 1,1 12
2	EN	IERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	18	\$116	15.23	\$1,762	
	₿.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	(12)	(\$25)	19.64	(\$500)	
	D.	PAPER		0	\$0		\$0	
		COAL			\$0	16.22	\$0	
	F.	TOTAL		6	90.2		 >	\$1,262
•	NO	N ENERGY ON THE	00 () (0007					
3		N-ENERGY SAVIN						
	Α.	1 DISCOUNT FAC		C. DEMAND SAVINGS)			\$488	
		2 DISCOUNTED S		OCT ()	(From Table A-2) =	14.68		
	R	NON-RECURRING		031 (-)	(3A x 3A1) =		\$7,157	
	٠.	ITEM	(+ <i>i</i> -)		YEAR OF	DISCOUNT	DIOCOLINTED	
				SAVINGS (1)	OCCURRENCE (2)	DISCOUNT	DISCOUNTED	
		a.		\$0	OOOOHNENCE (2)	FACTOR (3) 0.00	SAVINGS (4)	
		b.		\$0		0.00	\$0 \$0	
		C.		\$0		0.00	\$0	
		d TOTAL		\$0		0.00	\$0	
	C.	TOTAL NON-ENE	RGY DISCOUN	ITED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =	40	\$7 ,157
		PROJECT NON-EI		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		(== <u>=</u> = = = = = = = = = = = = = = =		ψr,10 <i>r</i>
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$417	
		a IF 3D1 => 3C T	HEN GO TO 4			•		
		b IF 3D1 < 3C TH	IEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =	0.35	
	•	c IF 3D1b => 1 T	HEN GO TO 4					
		d IF 3D1b < 1 TH	EN PROJECT	DOES NOT QUALIFY				
4	FIR	RST YEAR DOLLAR	SAVINGS (4) (4	COSTS (_)	(050	. 04 . /0D4 ±/05°°		
		TAL NET DISCOUN		• •	(2F3	+ 3A + (3B1d/25)) =		\$578
		SCOUNTED SAVING				(2F5 + 3C) =		\$8,419
-		SIR < 1 THEN PRO				(5/1F) =		1.77
7		MPLE PAYBACK (SP				(1F/4) =		8.22
		,	-			(1174)=		8.22

							•	
		LOCATION: White		-	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				RGY EFFICIENT WINDO	ws		FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/11/92	-	ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
_	1845	(COTLICT						
1		/ESTMENT	0007				A 8 4 8	
		CONSTRUCTION SIOH COST	COSI	(E 504 of 4 A) =			\$5,107	
				(5.5% of 1A) =			\$281	
		DESIGN COST		(6.0% of 1A) =			\$306	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$5,695	
		SALVAGE VALUE	· —	#B 4B			\$0	**
	г.	TOTAL INVESTME	:N I	(1D - 1E) =			>	\$5,695
2	ΕN	ERGY SAVINGS (+)	/ COST (=)					
•		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	4	\$23	15.23	\$357	
		DIST	V	0	\$0	17.28	\$0	
		NAT GAS	\$2.21	3	\$6	19.64	\$122	
		PAPER	4-		\$0	, , , ,	\$0	
	E.	COAL		_	\$0	16,22	\$0	
	F.	TOTAL		6	29.6		>	\$479
								• •
3	NO	N-ENERGY SAVIN	GS (+) / COST	(–)				
	A.	ANNUAL RECURP	ING (+/-) (ELE	C. DEMAND SAVINGS)	-		\$39	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	AVINGS (+) / C	OST (-)	(3A x 3A1) =		\$573	
	В.	NON-RECURRING	i (+/−)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENE	RGY DISCOUN	NTED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$573
	D.	PROJECT NON-E	NERGY TEST					
		1 25% MAXIMUM	NON-ENERGY	Y CALCULATION		(2F5 x 0.33) =	\$158	
		a IF 3D1 => 3C 1	THEN GO TO 4	•				
		b IF 3D1 < 3C TH	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =	0.11	
		c IF 3D1b => 1 T	HEN GO TO 4					
		d IF 3D1b < 1 TH	IEN PROJECT	DOES NOT QUALIFY				
		07 VELB 54	A.L.					
		IST YEAR DOLLAR		* *	(2F3	+ 3A + (3B1d/25)) =		\$69
		TAL NET DISCOUN				(2F5 + 3C) =		\$1,051
0				TMENT RATIO (SIR)		(5/1F) ≖		0.18
-		F SIR < 1 THEN PRO		NOT QUALIFY)				
′	311	IPLE PAYBACK (SP	D)			(1F/4) =		82.96

		LOCATION: Whit	a Sande Missil	e Ranne	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				- SETBACK/SETUP THI		7	FISCAL YEAR:	1992
		DISCRETE PORTIO		TOTAL	LAMOSTAT		FISCAL FEAR.	1992
		ANALYSIS DATE:	08/30/92	TOTAL	ECONOMIC LIFE:	15	PREPARED BY:	A. NIEMEYER
		ANALISIS DATE.	00/30/92		ECONOMIC LIFE.	15	PHERANED BI.	A. MIEWETCH
	IM	/ESTMENT						
٠		CONSTRUCTION	COST	_			6100	
		SIOH COST	0031	(5.5% of 1A) =			\$136 \$7	
		DESIGN COST		(6.0% of 1A) =			\$8	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$152	
		SALVAGE VALUE		(IXT IBT IC)=			•	
		TOTAL INVESTME	:NT	4D 4D =			\$0	4450
	г.	TOTAL INVESTME	:141	(1D – 1E) =			>	\$152
2	EN	ERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	124	\$806	10.79	\$8,696	
	В.	DIST		0	\$0	11.57	\$0	
	C.	NAT GAS	\$2.21	393	\$869	12.38	\$10,761	
	D.	PAPER		0	\$0		\$0	
	E.	COAL		-	\$0	11.35	\$0	
	F.	TOTAL		517	1,675.2		>	\$19,458
					,			*******
3	NO	N-ENERGY SAVIN	GS (+) / COST	(-)				
		ANNUAL RECURR		` '	=		\$0	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	10.67	•	
		2 DISCOUNTED S	SAVINGS (+) / C	:OST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRING	3 (+/ -)		, ,			
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c. •		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENE	RGY DISCOUN	ITED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =	•	\$0
		PROJECT NON-E				,		•
		1 25% MAXIMUM	NON-ENERGY	Y CALCULATION		(2F5 x 0.33) =	\$6,421	
		a IF 3D1 => 3C 1	THEN GO TO 4					
		b IF 3D1 < 3C Th	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T	HEN GO TO 4	•		,	•	
		d IF 3D1b < 1 TH	IEN PROJECT	DOES NOT QUALIFY			,	
4	Eir	OCT VEAD DOLLAR	CANINGO (-) '	COSTS ()	,-=-	. 04 . (05 : 155)		.
		RST YEAR DOLLAR TAL NET DISCOUN	• •		(21-3	+ 3A + (3B1d/25)) =		\$1,675
				TMENT RATIO (SIR)		(2F5 + 3C) =		\$19,458
J		F SIR < 1 THEN PRO				(5/1F) =		128.10
7		MPLE PAYBACK (SP		NOT QUALIFT)		/4 = / A		
,	311/	WELE LYIDAOV (2)	رن-			(1F/4) ⇒		0.09

		LOCATION: MEL	a Canda Missila	. Banana				
		LOCATION: Whit		i Hange – DRY BULB ECONOM!	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		DISCRETE PORTK		TOTAL	ZER ON ARU		FISCAL YEAR:	1992
		ANALYSIS DATE:	06/18/92	TOTAL	ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER
		ANALIGIO DATE.	00/16/52		LOCITOMIO LIFE.	15	FREFARED DI.	A. STOVER
1	IN۱	/ESTMENT						
		CONSTRUCTION	COST	=			\$997	
	В.	SIOH COST		(5.5% of 1A) =			\$55	
	C.	DESIGN COST		(6.0% of 1A) =			\$60	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$1,112	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$1,112
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
		ELEC	\$6.48	1	\$5	10.79	\$50	
		DIST	40.64	0	\$0	11.57	\$0	
		NAT GAS	\$2.21	0	\$0	12.38	\$0	
		PAPER		0	\$0	44.00	\$0	
		TOTAL		4	\$0	11.35	\$0	454
	г.	TOTAL		1	4.6		>	\$50
3	NO	N-ENERGY SAVIN	GS (+) / COST (_)				
_				. DEMAND SAVINGS)	=		\$0	
		1 DISCOUNT FAC			(From Table A-2) =	10.67	4 •	
		2 DISCOUNTED S	AVINGS (+) / CO	OST (-)	(3A x 3A1) =		\$0	
	В.	NON-RECURRING	i (+/~)		, ,		·	
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	,
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
				TED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$0
	D.	PROJECT NON-EN						
		1 25% MAXIMUM I		CALCULATION		(2F5 x 0.33) =	\$16	
		a IF 3D1 => 3C T b IF 3D1 < 3C TH		E CID		(055 - 054) / 45		
		c IF 3D1b => 1 T		COIN		(2F5 + 3D1) / 1F =		
				OOES NOT QUALIFY				
			2.00.002011	SOLO NOT GOALII T		•		
4	FIR	ST YEAR DOLLAR	SAVINGS (+) / C	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$5
		TAL NET DISCOUN		• •	, -	(2F5 + 3C) =		\$50
6	DIS	COUNTED SAVING	S-TO-INVEST	MENT RATIO (SIR)		(5/1F) =		0.04
	(IF	SIR < 1 THEN PRO	JECT DOES N	OT QUALIFY)				
7	SIM	IPLE PAYBACK (SP	В)			(1F/4) =		241.95

)						
	CONSTRUCTION COST ESTIMATE BREAKDOWN	E BREAKD(NMC							
CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SOI	JTH WADSW	ORTH BLVI	J., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	D 80227	
CONTRACT	CONTRACT FOR (Work to be performed) ECO'S - BLDG, 21695						PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
				MATERIAL COST	LCOST		LABOR COSTS			
Line	me <u>t</u>	Cuit of	Quantity			Manhours	Average		Other	Line
o O	Đ	Measure (2)	6	Unit	Total (5)	Mandays (6)	Rate	Total	Costs	Total
	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	·	166	2.19	363.54	0.09	27.60	403.18		\$766.72
	ENERGY EFFICIENT BALLASTS	EA	66	14.06	1307.58	0.85	27.60	2184.35		\$3,491.93
	TOTAL									\$4,258.65
2	ENERGY EFFICIENT WINDOWS REPLACEMENT									
	WINDOW REPLACEMENT	ΡS	298	14.83	4419.34	0.067	22.24	444.04		\$4,863.38
	DEMOLITION	SF	298	0.16	47.68	0.032	20.58	196.25		\$243.93
	TOTAL									\$5,107.31
င	SETBACK / SETUP THERMOSTAT (TOTAL)	EA	1	108.63	108.63	1.00	27.63	27.63		\$136.26
4	DRY BULB ECONOMIZER ON AHU									
	REFURBISH DAMPER MOTORS, DAMPERS & ACTUATORS	EA	2	75	150.00	4	35.81	286.48		\$436.48
	MIXED AIR SENSOR	EA		147.50	147.50	0.667	35.81	23.89		\$171.39
	RECEIVER CONTROLLER	Æ	-	235.00	235.00	1.00	35.81	35.81		\$270.81
	TUBING	J.	30	0.70	21.00	0.091	35.81	97.76		\$118.76
	TOTAL									\$997.44
	Source: Lightbulb Supply Co., Denver, CO; Means Electrical & Mechanical Cost Data, 1892;	d Cost Data, 1992;	Material prices in	clude 25 % over	need & profit, Labor S	Source: U.S. Dept. o	f Labor, General Wa	Material prices include 25 % overhead & profit, Labor Source; U.S. Dept. of Labor, General Wage Decision No. NM91-1	1-1	

Source: Lightbulb Suppiy Co., Denver, CO; Means Electrical & Mechanical Cost Data, 1892; Material prices include 26 % overhead & profit, Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1

ESOS STUDY AT WSMR - BUILDING 21695
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
NEW BLDG AUDIT: ALT 1-BSLN, ALT2-ECO

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) . Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:55: 1 2/29/92 Dataset Name: 21695 .TM

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System 1 Block RAD - RADIATION

******	*****	****	* C	OOLING COIL	PEAK *	***	******	****	****	***	**** CLG	SPACE	PEAK ****	****** HFA	TING COIL	PFAK *	****
Peaked at					0/ 0					*			0/0 *		Mo/Hr:		
Outside A			OAI	B/WB/HR:	0/ 0/	0.	0			*		ADB:	0 *		OADB:		
		en.		Dat Air	. 0.+	4:-	b.	- P			c.		Danama #		ale Cail	Daale	
		Spa Spa		Ret. Air					ercnt	-		pace	Percnt *	•		Peak	Percnt
Emiraliana		ens.+La		Sensible			Tot		f Tot		Sens		0f Tot *	Space Se		Sens	Of Tot
Envelope		(Btu	-	(Btuh)	-	un)	(Btu		(%)		(B	tuh)	(,,,,	(0.0		3tuh)	(%)
Skylite			0	(0	0.00			0	0.00 *		0	0	0.00
Skylite			0	(0	0.00	*		0	0.00 *		0	0	0.00
Roof Co			0	(0	0.00	*		0	0.00	•		5,421	39.85
Glass S			0	(•			0	0.00			0	0.00 *		0	0	0.00
Glass (0	(0	0.00			0	0.00		0	0	0.00
Wall Co			0	()			0	0.00			0	0.00	٠,٠		5,251	38.60
Partiti -			0					0	0.00			0	0.00 *		0	0	0.00
Exposed			0					0	0.00	*		0	0.00 *	_	91	-891	6.55
Infilt			0					0	0.00	*		0	0.00 *	-2,0	39 -	2,039	14.99
Sub Tot			0	()			0	0.00	*		0	0.00 *	-13,6	02 -13	3,602	100.00
Internal	Loads									*			*				
Lights			0	()			0	0.00	*		0	0.00 *		0	0	0.00
People			0					0	0.00	*		0	0.00 *		0	0	0.00
Misc	-		0	()	0		0	0.00	*		0	0.00 *		0	0	0.00
Sub Tot	tal==>		0	()	0		0	0.00	*		0	0.00 *		0	0	0.00
Ceiling L	Load		0	()			0	0.00	*		0	0.00 *		0	0	0.00
Outside A	Air		0	()	0		0	0.00	*		0	0.00 *		0	0	0.00
Sup. Fan	Heat							0	0.00	*			8.00 *			0	48
Ret. Fan	Heat			()			0	0.00	*			0.00 *			0	Unord
Duct Heat	t Pkup			()			0	0.00	*			0.00 *			0	0.00
OV/UNDR S	Sizing		0					0	0.00	*		0	0.00 *		0	0	0.00
Exhaust l	leat			()	0		0	0.00	*			0.00 *			0	0.00
Terminal	8ypass			()	0		0	0.00	*			0.00 *			0	0.00
Grand Tot	tal==>		0	()	0		0	0.00	*		0	0.00 *	-13,6	602 -13	3,602	100.00
				·co	N 1110 00	*1 6	F1 F6710W							·			
	Total	Capacit		Sens Cap.			ELECTION-		DB/WB,	/up	1 000	vina D	B/WB/HR	Gross Tot		ass (sf	
	(Tons)	(Mbi	•	(Mbh)	(cfm			-	Gra				Grains	Floor	.at Gt.	155 (\$1) (4)
Main Clg	0.0	-).O	0.0	(CIN	, 0	0.0	0.0).0		_					
Aux Clg	0.0		0.0	0.0		0	0.0	0.0).0	0.0	0.0		Part	0		
Opt Vent	0.0).O	0.0		0	0.0	0.0).0	0.0	0.0		Exflr	27		
Totals	0.0		0.0	0.0		U	0.0	0.0	'	,.0	0.0	0.0	0.0	Roof Wall	880 221		0 0
													•				•
	HEATIN			CTION		-		AIRFL	OWS (:fm)			ENGINEERING	CHECKS	TEMPE	RATURES	(F)
	Capacit	y Coi	LA	irfl Ent	Lvg		Type	Co	oling	1	Heating	Cl	g % CA	0.0	Type	Clg	Htg
	(Mbh)	1	(cf	n) Deg f	Deg	F	Vent		0		0	Cl	g Cfm/Sqft	0.00	SADB	0.0	68.1
Main Htg	-12.	.1		0 0.0	0.	0	Infil		0		48	Cl	g Cfm/Ton	0.00	Plenum	0.0	68.0
Aux Htg	0.	0		0.0	0.	0	Supply		0		0	ci	g Sqft/Ton	0.00	Return	0.0	68.0
Preheat	0.	.0		0.0	0.	0	Mincfm		0		0	Cl	g Btuh/Saft	0.00	Ret/OA	0.0	68.0
Reheat	0.	.0		0.0	0.	0	Return		0		0		. People	0	Runarnd	0.0	68.0
Humidif	0.	0		0.0	0.	0	Exhaust		0		0	Ht	g % OA	0.0	Fn MtrTC	0.0	0.0
Opt Vent	0.	.0		0 0.0	0.	0	Rm Exh		0		0	Ht	g Cfm/SqFt	0.00	Fn BldTt	0.0	0.0
Total	-12.	.1					Auxil		0		0	Ht	g Btuh/SqFt	-13.75	Fn Frict	0.0	0.0

System 2 Peak PTAC - PACKAGED TERMINAL AIR COND.

Peaked at 1	Time ==>		Mo/Hr:	7/16			*	Mo/	Hr: 7	7/21 1	•	Mo/Hr:	0/0	
Outside Air	r ==>	DAD	B/WB/HR:	97/ 64/ 49.0	l		*	OA	DB: 8	35		OADB:	0	
		Space	Ret. Air	Ret. Air	Net	Percnt	*	\$n	ace	Percnt 1	Space Pea	k Coil	Dook	Perci
	Sen	s.+Lat.	Sensible		Total			Sensi		Of Tot				Of To
Envelope Lo		(Stuh)	(Btuh)		(Btuh)	(%)		(Bt		(%)	opace con		tuh)	(
Skylite S		0	(0	0.00		,,,,	0	0.00	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	0	0	0.0
Skylite (0	Ċ		0				0	0.00		0	0	0.0
Roof Cond		4,682	C		4,682			6.	172	48.80		0	0	0.1
Glass So		0	Ċ	1	0			-,	0	0.00		0	0	0.
Glass Cor	nd	0	C)	0	0.00			0	0.00	k	0	0	0.
Wall Cond		2,220	Ċ]	2,220			6.	134	48.49	•	0	0	0.
Partition		0	•		0			-,	0	0.00	•	0	ō	0.
Exposed I		0			0				0	0.00	*	0	0	0.
Infiltra		1,067			1,067				343	2.71	*	0	0	0.
Sub Total		7,968	(ì	7,968				649	100.00		0	0	0.
Internal Lo		.,	•		. , ,	27101	*	,-,	047		*	•	٠	٠.
Lights		3,604	(1	3,604	27.05	*		0	0.00	*	0	0	0.
People		840		•	840				0	0.00		0	0	0.
Misc		250	() 0	250				0	0.00		0	0	0.
Sub Total	l==>	4,694	·		4,694				0	0.00		0	0	0.
Ceiling Lo		0	Ò		0,0,1				0	0.00		0	0	0.
Outside Air		0	ì		661				0	0.00		0	0	0.
Sup. Fan He		•	•		0				•	0.00	*	•	٥	0.
Ret. Fan H			()	0					≠ 0.00	*		0	0.
Ouct Heat I			,		0						*		0	0.
DV/UNDR Si	-	0	•		0				0		*	0	۵	0.
xhaust He	-	_	(0	0				•		*	•	0	0.
Terminal B			(0					0.00	*		0	0.
,	••			_	-		*				•		•	•
Grand Tota	(==>	12,662	t	0	13,323	100.00	*	12,	649	100.00	*	0	0	0.
			CO	DLING COIL S	ELECTION							AREAS-		
	Total Ca	pacity	Sens Cap.	Coil Airfl	Enteri	ng DB/WB	/HR	Leav	ring D	B/WB/HR	Gross Tota		ss (sf) (
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	g F Gra	ins	Deg F	Deg F	Grains	Floor	880	•	
ain Clg	1.5	18.0	17.0	468	79.2 5	6.6 4	3.5	49.8	39.8		Part	0		
ux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Exflr	27		
pt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	880		0
otals	1.5	18.0									Wall	221		0
	-HEATING	COIL SEL	ECTION		AI	RFLOWS (cfm)			ENGINEERIN	G CHECKS	TEMPER	ATURES	(F)
	Capacity			Lvg	Туре	Cooling		Heating		g % OA	6.4	Туре	Clg	H
	(Mbh)	(cf		_	Vent	30		0		g Cfm/Sqft		SADB	49.8	
ain Htg	-0.0		0 0.0	_	Infil	48		0		g Cfm/Ton	312.25	Plenum	78.0	
ux Htg	0.0		0 0.0		Supply	468		0		g Sqft/Ton		Return	78.0	
reheat	-0.0		468 1.		Mincfm	C		0		g Btuh/Sqf		Ret/OA	79.2	
eheat	0.0		0 0.		Return	468		0		. People	2	Runarnd	78.0	
umidif	0.0	•	0 0.0		Exhaust	30		0		g % OA	0.0	Fn MtrTD		
pt Vent	0.0		0 0.0		Rm Exh	0		0		g Cfm/SqFt		Fn BldTD		
						•		•			0.00	51410	٠.٠	

- SINGLE ZONE Peaked at Time ==> Mo/Hr: 7/17 Mo/Hr: 7/20 Outside Air ==> OADB/WB/HR: 96/63/49.0 **CADB: 88** OADB: 24 Space Ret. Air Ret. Air Net Percnt * Space Percnt * Space Peak Coil Peak Sens.+Lat. Sens ible Latent Total Of Tot * Sensible Of Tot * Of Tot Space Sens Tot Sens Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) * (Btuh) (%) * (Btuh) (Btuh) (%) Skylite Solr O Ω 0 0.00 * 0 0.00 * 0 Ω 0.00 Skylite Cond n n 0 0.00 * 0 0.00 * 0 0.00 Roof Cond 113,013 0 18.43 * 113,013 110,219 20.79 * -106,293 -106,293 15.11 6,889 0 6,889 Glass Solar 1.12 * 1.30 * 6,889 0 0 0.00 Glass Cond 4,500 0 4,500 0.73 * 4,500 0.85 -10,783 -10,783 1.53 Walt Cond 331,977 0 331,977 54.12 340,490 64.23 -378,688 -378,688 53.84 Partition 0 0.00 * ß O 0.00 * 0 0 0.00 n 0 Exposed Floor 0.00 * 0.00 * 0 -27,565 -27,565 3.92 Infiltration 40,003 40,003 6.52 * 30,916 5.83 * -120,605 -120,605 17.15 Sub Total==> 496,382 496,382 80.93 * 493,014 93.00 * -643,935 -643,935 91.56 Internal Loads Lights 24,587 24,587 4.01 * 24,587 4.64 0.00 People 4,200 4,200 0.68 * 2,300 0.43 0 0 0.00 Misc 10.244 0 10,244 1.67 * 1.93 * 10,244 0 0 0.00 39.031 Sub Total ==> 0 39,031 6.36 * 37,131 7.00 * 0 0.00 0 Ceiling Load 0 0 0.00 * 0.00 0 0.00 Outside Air 31,513 5.14 * 0.00 -91,702 46,432 Sup. Fan Heat 7.57 * 0.00 32,337 Ret. Fan Heat 0 0 0.00 * 0.00 0 0.00 Duct Heat Pkup 0 0.00 0.00 0 0.00 OV/UNDR Sizing 0 0.00 0.00 0 0.00 Exhaust Heat 0 0.00 0.00 0 0.00 Terminal Bypass 0 0.00 0.000.00 Grand Total ==> 535,413 613,359 100.00 * 100.00 * -643,935 -703,300 ------COOLING COIL SELECTION-----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR **Gross Total** Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 16,505 Main Clg 51.1 613.4 604.7 21,765 77.4 55.7 42.3 48.3 43.6 41.3 9,725 Part Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 799 Exflr 0.0 Opt Vent 0.0 0.0 ۵ 0.0 0.0 0.0 0.0 0.0 0.0 16,505 Roof Totals 51.1 613.4 Wall 12,959 186

	HEATING (COIL SELECTIO	N			IRFLOWS (cf	m)	ENGINEERING	CHECKS	TEMPER/	TURES	(F)
	Capacity	Coil Airfl	Ent	Lvg	Type	Cooling	Heating	Clg % DA	9.6	Type	Clg	Htg
	(Mbh)	(cfm)	Deg F	Deg F	Vent	2,082	2,082	Clg Cfm/Sqft	1.32	SADB	50.6	100.9
Main Htg	-1,083.5	21,765	46.7	98.7	Infil	2,738	2,738	Clg Cfm/Ton	425.82	Plenum	76.0	70.0
Aux Htg	0.0	0	0.0	0.0	Supply	21,765	21,765	Clg Sqft/Ton	322.91	Return	76.0	70.0
Preheat	-0.0	21,765	65.6	48.3	Mincfm	0	0	Clg Btuh/Sqft	37.16	Ret/OA	77.4	65.6
Reheat	0.0	0	0.0	0.0	Return	21,765	21,765	No. People	20	Runarnd	76.0	70.0
Humidif	0.0	0	0.0	0.0	Exhaust	2,082	2,082	Htg % OA	9.6	Fn MtrTD	0.7	0.0
Opt Vent	0.0	0	0.0	0.0	Rm Exh	0	0	Htg Cfm/SqFt	1.32	Fn BldTD	0.6	0.0
Total	-1,083.5				Auxil	0	0	Htg Btuh/SqFt	-65.64	Fn Frict	1.7	0.0

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BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 21695

					Room	Room						
					(Btu	/hr/sqf	t/F)				Mass	Capac.
Room	•			Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	Exflr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	<pre>1 Total/Ave.</pre>	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	2 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
2	RM 2 - OFFICES	0.388	0.750	0.000	0.000	0.140	1.140	1.259	0.417	0.000	88.7	18.64
Zone	2 Total/Ave.	0.388	0.750	0.000	0.000	0.140	1.140	1.259	0.417	0.000	88.7	18.64
3	RM 3 - HIGH BAY	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
Zone	3 Total/Ave.	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
System	3 Total/Ave.	0.658	0.750	0.000	0.000	0.140	1.140	1.259	0.645	0.000	110.3	22.96
Buildin	g	0.658	0.750	0.000	0.000	0.140	1.140	1.259	0.641	0.000	106.9	22.28

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 21695

BUILDING AREAS-----

Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Wet Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	RM 1 - STORAGE	i	1	880	88 0	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	0	880	0	0	221
System	1 Total/Ave.				880	0	27	0	0	880	0	0	221
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	0	880	0	0	221
System	2 Total/Ave.				880	0	27	0	0	880	0	0	221
2	RM 2 - OFFICES	1	1	6,003	6,003	2,475	265	0	0	6,003	186	6	2,729
Zone	2 Total/Ave.				6,003	2,475	265	0	0	6,003	186	6	2,729
3	RM 3 - HIGH BAY	1	1	10,502	10,502	7,250	534	0	0	10,502	0	0	10,044
Zone	3 Total/Ave.				10,502	7,250	534	0	0	10,502	0	0	10,044
System	3 Total/Ave.				16,505	9,725	799	0	0	16,505	186	1	12,773
Buildin	g				18,265	9,725	853	0	0	18,265	186	1	13,215

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

------SYSTEM LOAD PROFILE------

System Totals

Percent	Cool	ing Loa	d	Heatir	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	2.6	6	245	-54,778	11	316	1,111.7	0	0	0.0	0	0
5 - 10	5.3	7	290	-109,556	17	513	2,223.3	0	0	0.0	0	0
10 - 15	7.9	7	259	-164,334	17	506	3,335.0	0	0	0.0	0	0
15 - 20	10.5	9	357	-219,112	16	480	4,446.7	0	0	0.0	0	0
20 - 25	13.2	5	188	-273,890	13	398	5,558.4	0	0	0.0	0	0
25 - 30	15.8	5	192	-328,668	12	345	6,670.0	0	0	0.0	0	0
30 - 35	18.4	5	201	-383,446	8	232	7,781.7	0	0	0.0	0	0
35 - 40	21.0	5	178	-438,224	4	127	8,893.4	0	0	0.0	0	0
40 - 45	23.7	6	244	-493,002	1	39	10,005.1	0	0	0.0	0	0
45 - 50	26.3	8	301	-547,780	0	0	11,116.7	0	0	0.0	0	0
50 - 55	28.9	6	218	-602,558	0	0	12,228.4	0	0	0.0	0	0
55 - 60	31.6	8	324	-657,336	0	0	13,340.1	0	0	0.0	0	0
60 - 65	34.2	2	90	-712,114	0	0	14,451.8	0	0	0.0	0	0
65 - 70	36.8	4	175	-766,892	0	0	15,563.4	0	0	0.0	0	0
70 - 75	39.5	6	228	-821,670	0	0	16,675.1	0	0	0.0	0	0
75 - 80	42.1	5	186	-876,448	8	0	17,786.8	0	0	0.0	0	0
80 - 85	44.7	5	186	-931,226	0	0	18,898.4	0	0	0.0	0	0
85 - 90	47.4	2	62	-986,004	0	0	20,010.1	0	0	0.0	0	0
90 - 95	50.0	1	31	-1,040,782	0	0	21,121.8	0	0	0.0	0	0
95 - 100	52.6	0	0	-1,095,560	0	0	22,233.5	100	8,760	0.0	0	0
Hours Off	0.0	0	4,805	0	0	5,804	0.0	0	0	0.0	0	8,760

------ MONTHLY ENERGY CONSUMPTION -----

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	15,865	69	2,919	8
Feb	14,286	69	2,242	7
March	15,525	69	577	4
April	14,811	67	0	0
May	23,409	91	0	0
June	30,383	103	0	0
July	34,850	107	0	0
Aug	33,584	104	0	0
Sept	23,291	91	0	0
0ct	16,041	67	0	0
Nov	14,508	69	807	4
Dec	15,559	69	2,150	6
Total	252,112	107	8,696	8

Building Energy Consumption = Source Energy Consumption =

99,514 (Btu/Sq Ft/Year) 101,061 (Btu/Sq Ft/Year)

Floor Area = 17,3

17,385 (Sq Ft)

& Monthly KW = 975

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

*******************************	UTILITY	PEAK	CHECKSUMS

Utility ELECTRIC DEMAND

Peak Value 107.3 (kW)
Yearly Time of Peak 12 (hr) 7 (mo)

Hour 12 Month 7

Eqp.			Utility	Percnt	
Ref.	Equipment		Demand	Of Tot	
Num.	Code Name	Equipment Description	(kW)	(%)	
Cooling	Equipment				
1	EQ1307.C	PACKAGED TERMINAL AIR CONDITIONER	1.6	1.52	
2	EQ1172L	AIR-CLD COND COMP >55 TONS	38.4	35.81	
Sub Tota	al	•	40.0	37.33	
Sub Tota	al		0.0	0.00	
Air Movi	ing Equipment				
3		SUMMATION OF FAN ELECTRICAL DEMAND	11.2	10.43	
Sub Tota	al		11.2	10.43	
Sub Tota	al		0.0	0.00	
Miscella	aneous				
Lights			52.2	48.63	
Base Ut	tilities		0.0	0.00	
Misc Eq	•		3.9	3.62	
Sub Tota	al		56.0	52.24	
Grand To	otal		107.3	100.00	

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Trane Air Conditioning Economics
By: Trane Customer Direct Service Network
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************************ TRACE 600 ANALYSIS ****************** ***********************

ESOS STUDY AT WSMR - BUILDING 21695 WHITE SANDS MISSILE RANGE NM

US ARMY

EMC ENGINEERS, INC.

Time/Date Program was Run:

Dataset Name:

NEW BLOG AUDIT: ALT - BOLM (ALTZ-ECO) (REPLACE WINDOWS W/ ENERGY EFFICIENT WINDOWS)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) 106.0 (deg) Longitude: Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20 Air Density: 0.0653 (Lbm/cuft) Air Specific Heat: 0.2444 (Btu/lbm/F) Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft) Enthalpy Factor: 3.9171 (Lb-min./hr/cuft) Design Simulation Period: May To October System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

14:55: 1

21695 .TM

2/29/92

Trane Air Conditioning Economics By: Trane Customer Direct Service Network

-12.1

Total

System Block

RADIATION ****** COOLING COIL PEAK Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Peaked at Time ==> Mo/Hr: 0/ 0 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 CADB: 0 QADB: 24 Percnt * Space Peak Coil Peak Percnt Ret. Air Ret. Air Space Space Net Percnt Of Tot * Space Sens Tot Sens Of Tot Sens.+Lat. Sensible Latent Total Of Tot Sensible (Btuh) (Btuh) (%) (Btuh) (Btuh) (%) Envelope Loads (Btuh) (Btuh) (Btuh) (%) 0.00 0 0.00 0 0 0.00 Skylite Solr 0 0 0 0.00 0.00 ø 0.00 0 0 0 Skylite Cond 0 0 -5,421 39.85 Roof Cond 0 0 0 0.00 0 0.00 -5,421 0 0.00 Glass Solar 0 0 0.00 0 0.00 0 0 0 0.00 n 0.00 0.00 Glass Cond 0 0 0 Wall Cond 0 0.00 0.00 -5,251 -5,251 38.60 0.00 0.00 0.00 0 0 Partition ٥ -891 6.55 0 0.00 ٥ 0.00 -891 Exposed Floor Infiltration 0 0.00 0.00 * -2,039 -2,039 14.99 Sub Total==> 0 0.00 0.00 -13,602 -13,602 100.00 Internal Loads 0.00 * 0.00 0.00 n n Lights 0 0 O Ω 0.00 0 0 0.00 0 0.00 Û 0 People 0.00 0 0.00 Misc 0 0 0 0.00 0 0.00 * 0 C 0.00 Ω O 0.00 0 Sub Total ==> 0 0.00 0.00 0 0 0.00 Ceiling Load 0 0 ٥ 0 Outside Air 0 0 0 0.00 0 0.00 0 0.00 0.00 0.00 0 Sup. Fan Heat 0 0.00 0.00 0 Ret. Fan Heat 0 0 n 0.00 0.00 Duct Heat Pkup 0.00 0.00 ۵ 0.00 OV/UNDR Sizing 0 0.00 0 0.00 0.00 0.00 Exhaust Heat Terminal Bypass 0 0 0.00 0.00 0.00 Grand Total ==> 0 0.00 0.00 -13,602 -13,602 100.00 -----AREAS----------COOLING COIL SELECTION-----Sens Cap. Coil Airfl Glass (sf) (%) Total Capacity Entering DB/WB/HR Leaving DB/WB/HR **Gross Total** Deg F 880 (Tons) (Mbh) (Mbh) (cfm) Deg F Grains Deg F Deg F Grains Floor 0.0 0 Main Clg 0.0 0.0 0.0 0.0 0.0 0.0 Part 0 0.0 0.0 0.0 0.0 0.0 Exflr 27 Aux Clg 0.0 0.0 0.0 0.0 880 Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 0 Ω Totals 0.0 0.0 Wall 221 a 0 ------HEATING COIL SELECTION---------- AIRFLOWS (cfm)------- ENGINEERING CHECKS----TEMPERATURES (F)---Cooling Clg % OA Htg Coil Airfl Meating 0.0 Type Clg Capacity Ent Lvg Type (Mbh) (cfm) Deg F Deg F 0 n Clg Cfm/Sqft 0.00 SADB 0.0 68.1 Vent Main Htg 0 Clg Cfm/Ton 0.00 68.0 0.0 0.0 Infil 48 Plenum Aux Htg 0.0 0 0 0 Clg Sqft/Ton 0.00 Return 0.0 68.0 0.0 0.0 Supply 0 0.00 Preheat 0.0 0.0 0.0 Ω Clg Btuh/Sqft Ret/OA 0.0 68.0 0 Mincfm Reheat 0.0 0 0.0 0.0 Return 0 0 No. People 0 Runarnd 0.0 68.0 0 0.0 Fn MtrTD 0.0 Humidif 0.0 0.0 0.0 Exhaust 0 Htg % OA 0 Htg Cfm/SqFt 0.00 Fn BldTD 0.0 0.0 0.0 Rm Exh 0 0.0 Opt Vent

Htg Btuh/SqFt

-13.75

Fn Frict

Auxil

System 2 Peak PTAC - PACKAGED TERMINAL AIR COND. Peaked at Time ==> Mo/Hr: 7/16 Mo/Hr: 7/21 Mo/Hr: 0/ 0 Outside Air ==> OADB/WB/HR: 97/64/49.0 OADB: 85 OADB: Space Ret. Air Ret. Air Net Percnt * Percnt * Space Space Peak Coil Peak Sens.+Lat. Sensible Latent Total Of Tot * Sensible Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (%) * (Btuh) (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr 0 0 0 0.00 * 0 0.00 0 Ω 0.00 Skylite Cond 0 0 0 0.00 * 0 0.00 * n n 0.00 Roof Cond 4,682 0 4,682 35.14 * 6,172 48.80 * n 0.00 Glass Solar 0 0 0 0.00 * 0 0.00 * 0 0.00 Glass Cond 0 0 n 0.00 * 0 0.00 * 0 0.00 Wall Cond 2,220 2,220 16.66 * 6,134 48.49 O n 0.00 Partition 0 0 0.00 * 0 0.00 * 0 0 0.00 Exposed Floor 0 0 0.00 0 0.00 0 0.00 Infiltration 1,067 8.01 * 1,067 343 2.71 0 0.00 Sub Total ==> 7,968 O 7,968 59.81 12,649 100.00 0 n 0.00 Internal Loads Lights 3,604 0 3,604 27.05 O 0.00 * 0 0 0.00 People 840 6.30 * 840 O 0.00 * 0 0.00 Misc 250 Ω 250 1.88 * n 0 0.00 * 0 0 0.00 Sub Total ==> 4,694 Ω Ð 4,694 35.23 * 0.00 * Ð 0 0.00 Ceiling Load 0 ٥ 0 0.00 0.00 * 0 0 0.00 Outside Air 661 4.96 0.00 * 0.00 Sup. Fan Heat 0.00 O 0.00 * 0.00 Ret. Fan Heat 0 0 0.00 0.00 * 0.00 Duct Heat Pkup 0 0.00 0.00 * 0.00 OV/UNDR Sizing 0.00 0.00 * 0.00 Exhaust Heat 0 0.00 0 0.00 * 0.00 Terminal Bypass 0.00 0.00 0.00 Grand Total ==> 12.662 0 13,323 100.00 * 12,649 100.00 0.00 -----COOLING COIL SELECTION----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/KR Gross Total Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains 880 Floor Main Clg 1.5 18.0 17.0 468 79.2 56.6 43.5 49.8 39.8 26.3 Part O Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 ExFlr 0.0 27 Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 880 Totals 1.5 18.0 Wall 221 0 0 ------HEATING COIL SELECTION-----------AIRFLOWS (cfm)------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Lvg Type Cooling Heating Cig % OA 6.4 Type Clg Hta (Mbh) (cfm) Deg F Deg F Vent 30 0 Clg Cfm/Sqft 0.53 SADB 49.8 0.0 Main Htg -0.0 0 0.0 0.0 Infil 48 Clg Cfm/Ton 312.25 Plenum 78.0 0.0 Aux Htg 0.0 0 0.0 0.0 Supply 468 0 Clg Sqft/Ton 586.67 Return 78.0 0.0 Preheat -0.0 468 1.5 49.8 Mincfm 0 0 Clg Btuh/Sqft 20.45 Ret/OA 79.2 0.0 Reheat 0.0 0 0.0 0.0 Return 468 n No. People 2 Runarnd 78.0 0.0 Humidif 0.0 0 0.0 0.0 Exhaust 30 Htg % CA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0.0 0.0 Rm Exh 0 Htg Cfm/SqFt 0.00 Fn BldTD 0.0 0.0 Total 0.0

Htg Btuh/SqFt

0.00

Fn Frict

0.0

Auxil

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System 3 Peak SZ -	SINGLE ZONE
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******	******	***** CC	OLING COIL	PEAK *****	*****	*****	****	*** CLG	SPACE	PEAK *****	***** HEA1	TING COIL PI	EAK **	****
	Time ==>		Mo/Hr: 7				*		Hr: 7	7/20 *		Mo/Hr: 13,	/ 1	
Outside A				6/ 63/ 49.0	1		*	QA.	DB: 8	38 *		OADB: 2	4	
							*			*				
		Space	Ret. Air	Ret. Air	Net	Percnt	*	Sp	ace	Percnt *	Space Pea	ak Coil P	eak	Percnt
	Se	ns.+Lat.	Sensible	Latent	Total	Of Tot	*	Sensi	ble	Of Tot *	Space Set	ns Tot S	ens	Of Tot
Envelope		(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Bt	uh)	(%) *	(8tul	n) (Bt	uh)	(%)
Skylite		0	0		0	0.00	*		0	0.00 *		0	0	0.00
Skylite		0	0		0	0.00	*		0	0.00 *		0	0	0.00
Roof Co		113,013	0		113,013	18.73	*	110,	219	21.14 *	-106,29	93 -106,	293	15.45
Glass S		4,655	0		4,655		*		655	0.89 *		0	0	0.00
Glass C		1,245	0		1,245				245	0.24 *	-2,7	73 -2,	773	0.40
Wall Co		331,977	0		331,977			340,		65.32 *	-378,6		688	55.04
Partiti		0	·		031,711				0	0.00 *	•	0	0	0.00
		0			0				0	0.00 *	-27,5	65 -27,	565	4.01
Exposed					36,707			27	549	5.28 *	-113,3			16.47
Infiltr		36,707	0		487,597			484		92.88 *	-628,6			91.37
Sub Tot		487,597	U		401,371	00.77	*	404,	127	*	00,0			
Internal	Loads	2/ 507	0		24,587	4.07	7 *	24	587	4.72 *		0	0	0.00
Lights		24,587	Ū		4,200			-	,300	0.44 *		0	0	0.00
People		4,200	0	0	10,244				,244	1.97 *		0	0	0.00
Misc Sub Tot	+al>	10,244	. 0	_	39,031			-	131	7.12 *		0	0	0.00
Sub Tot		39,031 0	0	•	37,031		, *	J.,	0	0.00 *		0	G	0.00
Ceiling L		_	0		31,513				0	0.00 *		0 -91,	-	13.33
Outside A		0	U	Ū	45,381					0.00 *		32,		-4.70
Sup. Fan			•		0					0.00 *		,	0	0.00
Ret. Fan			0		0					0.00 *			0	0.00
Duct Heat	•		0		0				0	0.00 *		0	0	0.00
OV/UNDR S	_	0	•	•	0				٠	0.00 *		·	0	0.00
Exhaust 1			0) *			0.00 *			0	0.00
Terminal	Bypass		0	0	·	0.00	, . *			*			•	0.00
		F2/ /20	•	. 0	407 527	100.00		521	,290	100.00 *	-628,6	54 -688,	019	100.00
Grand Tot	(a(==>	526,628	U	. 0	603,323	100.00	,	251	, 2, 0	100.00	020,0	J4 000,	• . ,	
			coo	LING COIL SE	ELECTION							AREAS		
	Total (Capacity	Sens Cap.			ing DB/W	B/HR	Lea	ving D	B/WB/HR	Gross Tot	al Glas	s (sf)	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)		g F Gr		Deg F	Deg F	Grains	Floor	16,505		
Main Clg	50.3	603.5	594.8	21,272			42.1	48.2	43.5		Part	9,725		
Aux Clg	0.0	0.0	0.0	0		0.0	0.0	0.0	0.0	0.0	ExFlr	799		
Opt Vent	0.0	0.0	0.0	0		0.0	0.0	0.0	0.0	0.0	Roof	16,505		0 0
Totals	50.3	603.5	•••								Wall	12,959	18	36 1
101010	2010	0.0												
	HEATING	COIL SEL	ECTION		A1	RFLOWS	(cfm)			ENGINEERING	CHECKS	TEMPERA	TURES	(F)
	Capacity	y Coil A	irfl Ent	Lvg	Type	Coolin	g	Heating	Cl	g % OA	9.8	Type	Clg	Htg
	(Mbh)	(cf			Vent	2,08	2	2,082	Cl	g Cfm/Sqft	1.29	SADB	50.4	100.9
Main Htg	-1,083.				Infil	2,57	3	2,573		g Cfm/Ton	422.97	Plenum	76.0	70.0
Aux Htg	0.0	•	0 0.0		Supply	21,27		21,272		g Sqft/Ton	328.18	Return	76.0	70.0
Preheat	-0.1				Mincfm		0	. 0		g Btuh/Sqft	36.57	Ret/OA	77.4	65.5
Reheat	0.0		0 0.0		Return	21,27	2	21,272	No	. People	20	Runarnd	76.0	70.0
Humidif	0.1		0 0.0		Exhaust	2,08		2,082		g % OA	9.8	Fn MtrTD	0.7	0.0
Opt Vent	0.0		0 0.0		Rm Exh		0	0		g Cfm/SqFt	1.29	Fn BldTD	0.6	0.0
Total	-1,083.			***	Auxil		0	0		g Btuh/SqFt	-65.64	Fn Frict	1.7	0.0
1000	.,	-			-					• •				

BUILDING U-VALUES - ALTERNATIVE 2 DBL PANE GREY GLASS - BLDG 21695

BUILDING U-VALUES-----

			Room U-Values									Room
_					(Btu	i/hr/sq1	t/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	2 Total/Ave.	0.000	0.750	0.000	0.000		0.000	0.000	0.540	0.000	75.2	
2	RM 2 - OFFICES	0.388	0.750		0.000		0.315		0.417	0.000		15.93
Zone	2 Total/Ave.	0.388	0.750	0.000	0.000		0.315				88.7	18.64
3	RM 3 - HIGH BAY	0.750	0.750	0.000	0.000		0.000		0.417	0.000	88.7	18.64
Zone	3 Total/Ave.							0.000	0.706	0.000	122.7	25.43
	_	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
System	3 Total/Ave.	0.658	0.750	0.000	0.000	0.140	0.315	0.324	0.645	0.000	110.3	22.96
Buildin	g	0.658	0.750	0.000	0.000	0.140	0.315	0.324	0.641	0.000	106.9	22.28

BUILDING AREAS - ALTERNATIVE 2 DBL PANE GREY GLASS - BLDG 21695

BUILDING AREAS -----

Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	0	880	0	0	221
System	<pre>1 Total/Ave.</pre>				880	0	27	0	Ō	880	0	0	221
. 1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	ō	880	0	0	221
System	2 Total/Ave.				880	0	27	0	Ō	880	0	0	
2	RM 2 - OFFICES	1	1	6,003	6,003	2,475	265	0	0	6,003	186		221
Zone	2 Total/Ave.				6,003	2,475	265	0	0	6,003	186	6	2,729
3	RM 3 - HIGH BAY	1	1	10,502	10,502	7,250	534	0	0	10,502		6	2,729
Zone	3 Total/Ave.			·	10,502	7,250	534	0	0	•	0	0	10,044
System	3 Total/Ave.				16,505	9,725	799		-	10,502	0	0	10,044
Buildin	g				18,265	•		0	0	16,505	186	1	12,773
	_				10,203	9,725	853	0	0	18,265	186	1	13,215

SYSTEM LOAD PROFILE-----

System Totals

Percent	Cool	ing Load	d	Heatir	g Load		Cooling			Heating		Hours
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.		Hours	Cap.	Hours (%)	nours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(4)	
0 - 5	2.6	5	213	-54,778	11	316	1,087.0	0	0	0.0	0	0
5 - 10	5.2	8	303	-109,556	17	513	2,174.1	0	.0	0.0	0	-
10 - 15	7.8	7	259	-164,334	18	522	3,261.1	0	0	0.0	0	0
15 - 20	10.4	9	357	-219,112	16	464	4,348.2	0	0	0.0	0	0
-	12.9	4	172	-273,890	13	398	5,435.2	0	0	0.0	0	0
	15.5	4	167	-328,668	11	335	6,522.3	0	0	0.0	0	0
25 - 30	18.1	5	211	-383,446	8	242	609.3	0	0	0.0	0	0
30 - 35	20.7	5	209	-438,224	4	127	8,696.3	0	0	0.0	0	0
35 - 40 40 - 45	23.3	6	253	-493,002	1	39	9,783.4	0	0	0.0	0	0
	25.9	7	287	-547,780	0	0	10,870.4	0	0	0.0	0	0
45 - 50	28.5	6	223	-602,558	0	0	11,957.5	0	0	0.0	0	0
50 - 55	_	7		-657,336	0	0	13,044.5	0	0	0.0	0	0
55 - 60	31.1	4		-712,114	0	0	14,131.6	0	0	0.0	0	0
60 - 65	33.7	5	-	-766,892	. 0		15,218.6	0	0	0.0	0	
65 - 70	36.3	5		-821,670	0		16,305.6	0	0	0.0	0	0
70 - 75	38.8			-876,448	0		17,392.7	0	0	0.0	0	
75 - 80	41.4	4		-931,226	0		18,479.7		0	0.0	0	0
80 - 85	44.0	5		-986,004	0	-	19,566.8		0	0.0	0	0
85 - 90	46.6	2		-1,040,782			20,653.8		0	0.0	0	0
90 - 95	49.2	1	_			•	21,740.8		8,760	0.0	0	0
95 - 100 Hours Off	51.8 0.0		0 4,824	-1,095,560 0	_	-	0.0			0.0		8,760

MONTHLY ENERGY CONSUMPTION

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	15,865	69	2,911	7
Feb	14,286	69	2,232	7
March	15,525	69	576	4
April	14,800	67	0	0
May	23,295	91	0	0
June	30,169	102	0	0
July	34,560	107	0	0
Aug	33,333	103	0	0
Sept	23,141	91	0	0
Oct	16,009	67	0	0
Nov	14,508	69	805	4
Dec	15,559	69	2,144	6
Total	251,051	107	8,668	7

Building Energy Consumption = Source Energy Consumption =

99,147 (Btu/Sq Ft/Year) 100,689 (Btu/Sq Ft/Year) Floor Area =

17,385 (Sq Ft)

Emonthly KW = 973

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

***************************************	UTILITY	PEAK	CHECKSUMS

Utility ELECTRIC DEMAND

Peak Value 106.7 (kW)

Yearly Time of Peak 12 (hr) 7 (mo)

Hour 12 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	
Cooling Ed	quipment			
1 2	EQ1307.C EQ1172L	PACKAGED TERMINAL AIR CONDITIONER AIR-CLD COND COMP >55 TONS	1.6 37.9	1.53 35.48
Sub Total			39.5	37.00
Sub Total			0.0	0.00
Air Moving	; Equipment			
3		SUMMATION OF FAN ELECTRICAL DEMAND	11.2	10.48
Sub Total			11.2	10.48
Sub Total			0.0	0.00
Miscellane	eous			
Lights Base Util Misc Equi Sub Total			52.2 0.0 3.9 56.0	0.00
Grand Tota	al		106.7	100.00

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*************
   TRACE
      600
       ANALYSIS
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ESOS STUDY AT WSMR - BUILDING 21695 WHITE SANDS MISSILE RANGE NM US ARMY

EMC ENGINEERS, INC.

LOW WATTAGE PLUGESCENT LIGHTING) NEW BLDG AUDIT: ALT T-BSEN, ALT2-ECO)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg)

Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg)

Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft) Air Specific Heat: 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft) Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:55: 1 2/29/92 Dataset Name: 21695 .TM

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

Block RAD - RADIATION System Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Peaked at Time ==> Mo/Hr: 0/ 0 OADB/WB/HR: 0/ 0/ 0.0 OADB: 0 OADB: 24 Outside Air ==> Percnt * Space Ret. Air Ret. Air Net Percnt Space Space Peak Coil Peak Total Of Tot Sensible Of Tot Sens.+Lat. Sensible Space Sens Tot Sens Of Tot Latent (Btuh) (Btuh) (Btuh) (%) (Btuh) (Btuh) (Btuh) (%) (Btuh) (%) Envelope Loads 0.00 0.00 · Skylite Solr 0 0 0.00 0 0 0 0 0.00 0.00 0 0.00 Skylite Cond 0 -5,421 0.00 0 0.00 -5,421 39.85 Roof Cond 0 0 n 0.00 0.00 0 0.00 Glass Solar 0 0 0 0 0 Glass Cond 0 0 0 0.00 0 0.00 0 0 0.00 0.00 -5,251 Wall Cond 0 0 0 0.00 0 -5,251 38.60 0.00 * 0.00 0 0.00 Partition 0 0 0 0 Exposed Floor 0 0.00 0 0.00 * -891 -891 6.55 Infiltration 0 0 0.00 0 0.00 * -2,039 -2,039 14.99 Sub Total ==> 0.00 0 0.00 * -13,602 -13,602 100.00 0 Internal Loads Lights 0 0 0.00 0 0.00 Đ 0 0.00 0.00 People 0 0 0.00 0 0.00 0 0 0.00 * 0.00 Misc O O û 0 0.00 * 0 0 ٥ Sub Total ==> 0 0 0 0.00 * ٥ 0.00 * 0 0.00 Ceiling Load 0 0.00 * 0.00 * 0 0 0.00 0.00 * 0.00 * Outside Air Sup. Fan Heat n 0.00 * 0.00 O 0 0.00 0.00 0.00 Ret. Fan Heat 0 0 Duct Heat Pkup 0 0.00 0.00 0 0.00 OV/UNDR Sizing 0 0.00 0.00 0 0 0.00 0 0.00 0.00 0.00 Exhaust Heat O a O Terminal Bypass 0 0.00 0.00 0.00 Grand Total ==> 0.00 0.00 -13,602 -13,602 100.00 -----COOLING COIL SELECTION-----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/KR Leaving D8/W8/HR **Gross Total** Glass (sf) (%) (Tons) (Mbh) (Mbh) Deg F Deg F Grains Deg F Deg F Grains Floor 880 (cfm)

Main Cig	0.0	0.0	0.0	U	0.0	0.0 0	.0 0.0	0.0	0.0	Part	υ		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0 0	.0 0.0	0.0	0.0	Exflr	27		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	.0 0.0	0.0	0.0	Roof	880		0 0
Totals	0.0	0.0								Wall	221		0 0
	HEATING	COIL SELECTIO)N			AIRFLOWS (c	fm)	E	NGINEERING	CHECKS	TEMPERA	TURES	(F)
	Capacity	Coil Airfl	Ent	Lvg	Type	Cooling	Heating	Clg	% OA	0.0	Type	Cig	Htg
	(Mbh)	(cfm)	Deg F	Deg F	Vent	0	0	Clg	Cfm/Sqft	0.00	SADB	0.0	68.1
Main Htg	-12.1	0	0.0	0.0	Infil	0	48	Clg	Cfm/Ton	0.00	Plenum	0.0	68.0
Aux Htg	0.0	0	0.0	0.0	Supply	0	0	Clg	Sqft/Ton	0.00	Return	0.0	68.0
Preheat	0.0	. 0	0.0	0.0	Mincfm	0	0	Clg	Btuh/Sqft	0.00	Ret/OA	0.0	68.0
Reheat	0.0	0	0.0	0.0	Return	0	0	No.	People	0	Runarnd	0.0	68.0
Humidif	0.0	0	8.0	0.0	Exhaust	0	. 0	Htg	% OA .	0.0	Fn MtrTD	0.0	0.0
Opt Vent	0.0	0	0.0	0.0	Rm Exh	0	0	Htg	Cfm/SqFt	0.00	Fn BldTD	0.0	0.0
Total	-12.1				Auxil	0	0	Htg	Btuh/SqFt	-13.75	Fn Frict	0.0	0.0

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

System 2 Peak PTAC - PACKAGED TERMINAL AIR COND.

Mo/Hr: 7/21 Mo/Hr: 0/ 0 Mo/Hr: 7/16 Peaked at Time ==> OADB: 0 OADB: 85 OADB/WB/HR: 97/ 64/ 49.0 Outside Air ==> Coil Peak Percnt * Space Peak Percnt Net Percnt * Space Ret. Air Ret. Air Space Space Sens Tot Sens Of Tot Of Tot Of Tot * Sensible Sens.+Lat. Sensible Latent Total (Btuh) (%) (Btuh) (Btuh) (%) (Btuh) (%) (Rtuh) (Btuh) (Btuh) Envelope Loads 0 0.00 0.00 0 0.00 0 n 0 n Skylite Solr 0 0.00 0 0 0.00 0 0.00 O Skylite Cond 0 6,172 48.80 0 0 0.00 35.14 * 4,682 0 4,682 Roof Cond 0.00 0 0 0.00 0 0.00 * 0 0 0 Glass Solar 0 0.00 0 0.00 0 0.00 * n O 0 Glass Cond 0 0 0.00 16.66 6,134 48.49 2,220 2,220 Wall Cond 0.00 0 0.00 0 0 0.00 0 Partition n n 0.00 0 0.00 0 0.00 0 Exposed Floor 2.71 0 0 0.00 1,067 8.01 343 Infiltration 1,067 12,649 100.00 0 0 0.00 59.81 7,968 Sub Total ==> 7,968 Internal Loads 0.00 n ۵ 0.00 3,604 27.05 0 0 3,604 Lights 0.00 ٥ n 0.00 840 6.30 People 840 0.00 0 0 0.00 250 1.88 n 250 0 Misc 4,694 0 0.00 0 0.00 35.23 4,694 0 0 Sub Total ==> 0.00 0.00 0 0 0.00 0 0 Ceiling Load 0.00 661 4.96 0.00 n 0 0 Outside Air 0 0.00 0.00 0.00 Sup. Fan Heat 0.00 0.00 O 0.00 0 Ret. Fan Heat 0.00 0.00 0.00 * 0 0 Duct Heat Pkup 0.00 0.00 0 0.00 OV/UNDR Sizing 0.00 0.00 0 0 0.00 Exhaust Heat 0.00 0.00 0 0.00 0 Terminal Bypass 0.00 100.00 0 13,323 100.00 * 12,649 12,662 Grand Total==> ------COOLING COIL SELECTION----------AREAS-----Glass (sf) (%) Entering DB/WB/HR Leaving DB/WB/HR Gross Total Total Capacity Sens Cap. Coil Airfl 880 Floor (Tons) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains 39.8 0 Main Clg 1.5 18.0 17.0 468 79.2 56.6 43.5 49.8 26.3 Part 27 0.0 0.0 0.0 ExFlr 0.0 0.0 0.0 0 0.0 0.0 0.0 Aux Clg 880 0 0 0.0 0.0 0.0 0.0 Roof Opt Vent 0.0 0.0 0.0 0 0.0 Wall 221 Totals 18.0 -- TEMPERATURES (F)---------HEATING COIL SELECTION---------- AIRFLOWS (cfm)------- ENGINEERING CHECKS--Туре Clg Htg Cooling **Heating** Clg % OA 6.4 Capacity Coil Airfl Ent Lvg Type 49.8 0.0 30 0 Clg Cfm/Sqft 0.53 SADB (Mbh) (cfm) Deg F Deg F Vent 78.0 0.0 48 0 Clg Cfm/Ton 312.25 Plenum 0.0 Infil Main Htg -0.0 0 0.0 0.0 468 0 Clg Sqft/Ton 586.67 Return 78.0 0.0 0.0 Supply Aux Htg 0.0 0 0 0 Clg Btuh/Sqft 20.45 Ret/OA 79.2 0.0 49.8 Mincfm Preheat -0.0 468 1.5 0 2 Runarnd 78.0 0.0 No. People 0.0 468 Reheat 0.0 0 0.0 Return 0.0 Fn MtrTD 0.0 0.0 0 Htg % OA 0.0 0.0 **Exhaust** 30 Humidif 0.0 0 0.0 0 0 Htg Cfm/SqFt 0.00 Fn BldTD 0.0 0 0.0 0.0 Rm Exh Opt Vent 0.0 0.00 Fn Frict 0.0 0.0 Htg Btuh/SqFt Auxil Total 0.0

System 3 Peak SZ - SINGLE ZONE

Peaked at	Time ==	>	Mo/Hr:	7/17			*	Mo/H	Hr: 7	7/20 *	<i>!</i> "	Mo/Hr: 13/ 1	
Outside A	ir ==>	OAD	B/WB/HR:	96/ 63/ 49	0.0		*	CAC	DB: 8	88 *	•	OADB: 24	
		Space	Ret. Ai	r Ret. Air	· Na	t Perci	nt *	Spe	ace	Percnt *	Space Pe	ak Coil Peak	Percnt
	•	Space ens.+Lat.	Sensible		_			Sensil		Of Tot	Space Se		
Envelope		(8tuh)	(Btuh	_			%) *	(Btu		(%) *	•		(%)
Skylite		0	-)			00 *	•	0	0.00	•	0 0	0.00
Skylite		0)			00 *		0	0.00	•	0 0	0.00
Roof Co		113,013		0	113,01		65 *	110,2	219	21.05	-106,2	93 -106,293	15.11
Glass S		6,889		0	6,88		14 *	=	889	1.32	•	0 0	0.00
Glass C		4,500		0	4,50		74 *	•	500	0.86	-10,7	83 -10,783	1.53
Wall Co		331,977		0	331,97		78 *	340,4		65.03	-378,6	88 -378,688	53.84
Partiti		0		-			00 *		0	0.00	•	0 0	0.00
Exposed		Ô					00 *		0	0.00	-27,5	65 -27,565	3.9
Infiltr		40,003			40,00		60 *	30,9	-	5.90	•	•	
Sub Tot		496,382		0	496,38		90 *	493,0		94.16			
internat		470,302			470,30		· *		•••		•	•	
Lights	Loads	18,030		0	18,03	so 2.	97 *	18,0	030	3.44	t .	0 0	0.0
People		4,200		•	4,20		69 *	-	300	0.44		0 0	0.0
Misc		10,244		0 (10,24		69 *	10,3		1.96		0 0	0.0
Sub Tot	-al==>	32,475			32,47		36 *	30,		5.84		0 (0.0
Ceiling L		0		0			00 *		0	0.00	*	0 (0.0
Dútside A		0			31,51		20 *		0	0.00	k	0 -91,702	13.0
Sup. Fan		·		•	45,70		54 *			0.00	*	32,337	7 -4.6
Ret. Fan				0			00 *			0.00	k		0.0
Ouct Heat				0			00 *			0.00	*	(0.0
OV/UNDR S		0				0 0.	00 *		0	0.00	*	0 (0.0
Exhaust i	-			0 (0	0 0.	00 *			0.00	*	(0.0
Terminal				0	0	0 0.	00 *			0.00	*	(0.0
	••						*			•	*		
Grand Tot	tal==>	528,857		0	0 606,0	74 10 0.	.00 *	523,	589	100.00	* -643,9	35 -703,300	100.0
					SELECTION-							AREAS	
	Total	Capacity	Sens Cap.	Coil Air		ring DB/			-	B/WB/HR	Gross Tot		(sf) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)		Deg F G		_		Grains		16,505	
ain Clg	50.5	606.1	597.4	21,42		55.7	42.2	48.2	43.5		Part	9,725	
ux Clg	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0		ExFlr	799	^
pt Vent	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		16,505	0
otals (50.5	606.1									Wall	12,959	186
	HEATI	G COIL SEL	ECTION)		ENGINEERIN		TEMPERATU	
	•	ty Coil A			Type	Cooli	_	Heating		.g % OA	9.7	• •	lg Htg
	(Mbh)		_		Vent	2,0		2,082		g Cfm/Sqft			0.5 101.
lain Htg	-1,083	-			Infil	2,7		2,738		g Cfm/Ton			6.0 70.
lux Htg	0.		0 0.		Supply	21,4		21,424		g Sqft/Ton			6.0 70.
reheat	-0.				Mincfm		, 0	0		.g Btuh/Sqf			7.4 65.
teheat	0.		0 0.		Return	21,424		21,424		People	20	Runarnd 76.	
lumidif	0.		0 0.		Exhaust	2,0		2,082		:g % OA	9.7		0.7 0.
Opt Vent	0.		0 0.	0.0	Rm Exh		0	0		g Cfm/SqFt			0.6
otal	-1,083	•			Auxil		0	0	U+	g Btuh/SqF	t -65.64	Fn Frict	

BUILDING U-VALUES - ALTERNATIVE 3
REDUCE LIGHTING ENERGY - BLDG 21695

------ BUILDING U-VALUES ------

		•••••			Roc	m U-Val	ues				Room	Room
					(Btu	ı/hr/sqf	t/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	2 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
2	RM 2 - OFFICES	0.388	0.750	0.000	0.000	0.140	1.140	1.259	0.417	0.000	88.7	18.64
Zone	2 Total/Ave.	0.388	0.750	0.000	0.000	0.140	1.140	1.259	0.417	0.000	88.7	18.64
3	RM 3 - HIGH BAY	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
Zone	3 Total/Ave.	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
System	3 Total/Ave.	0.658	0.750	0.000	0.000	0.140	1.140	1.259	0.645	0.000	110.3	22.96
Buildin	ng	0.658	0.750	0.000	0.000	0.140	1.140	1.259	0.641	0.000	106.9	22.28

BUILDING AREAS - ALTERNATIVE 3
REDUCE LIGHTING ENERGY - BLDG 21695

-BUILDING AREAS

Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	0	880	0	0	221
System	1 Total/Ave.				880	0	27	0	0	880	0	0	221
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 al/Ave.				880	0	27	0 0		880	0 0		221
System	2 Total/Ave.				880	0	27	0	0	880	0	0	221
2	RM 2 - OFFICES	1	1	6,003	6,003	2,475	265	0	0	6,003	186	6	2,729
Zone	2 Total/Ave.				6,003	2,475	265	0	0	6,003	186	6	2,729
3	RM 3 - HIGH BAY	1	1	10,502	10,502	7,250	534	0	0	10,502	0	0	10,044
Zone	3 Total/Ave.				10,502	7,250	534	0	0	10,502	0	0	10,044
System	3 Total/Ave.				16,505	9,725	799	0	0	16,505	186	1	12,773
Buildin	g				18,265	9,725	853	0	0	18,265	186	1	13,215

System Totals

Per	Cooling 1	Load		Heating Los	ad		- Cooling Airf	ow		Heating Airf	low	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	•
0 - 5	2.6	5	180	-54,778	9	259	1,094.6	0	0	0.0	0	0
5 - 10	5.2	8	314	-109,556	19	570	2,189.2	0	0	0.0	0	0
10 - 15	7.8	6	217	-164,334	17	489	3,283.8	0	Ō	0.0	0	0
15 - 20	10.4	9	337	-219,112	16	478	4,378.4	0	Ō	0.0	0	0
20 - 25	13.0	5	208	-273,890	14	407	5,473.0	0	0	0.0	0	0
25 - 30	15.6	6	226	-328,668	12	345	6,567.6	0	0	0.0	0	ō
30 - 35	18.2	5	180	-383,446	8	242	7,662.2	0	0	0.0	0	0
35 - 40	20.8	4	155	-438,224	4	127	8,756.8	0	Ö	0.0	0	0
40 - 45	23.4	7	274	-493,002	1	39	9,851.4	0	0	0.0	0	0
45 - 50	26.0	7	277	-547,780	0	0	10,946.0	0	0	0.0	0	0
50 - 55	28.6	6	242	-602,558	0	0	12,040.6	0	0	0.0	0	0
55 - 60	31.2	7	254	-657,336	0	0	13,135.2	0	0	0.0	0	0
60 - 65	33.8	4	162	-712,114	0	0	14,229.8	0	0	0.0	0	0
65 - 70	36.4	4	165	-766,892	0	0	15,324.4	0	0	0.0	0	0
70 - 75	39.0	5	186	-821,670	0	0	16,419.1	0	0	0.0	0	0
75 - 8 0	41.6	5	185	-876,448	0	0	17,513.7	0	0	0.0	0	0
80 - 85	44.2	5	197	-931,226	0	0	18,608.3	0	0	0.0	0	0
85 - 90	46.8	2	82	-986,004	0	0	19,702.9	0	0	0.0	0	0
90 - 95	49.4	1	31	-1,040,782	0	0	20,797.5	0	0	0.0	0	0
95 - 100	52.0	0	0	-1,095,560	0	0	21,892.1	100	8,760	0.0	0	0
Hours Off	0.0	0	4,888	0	0	5,804	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3

 MONTHLY	ENERGY	CONSUMPTION

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	15,499	67	2,946	8
Feb	14,008	67	2,272	7
March	15,131	67	586	4
April	14,365	65	0	0
May	22,892	89	0	0
June	29,861	100	0	0
July	34,356	105	0	0
Aug	33,035	102	0	0
Sept	22,809	89	0	0
Oct	15,555	65	0	0
Nov	14,158	67	825	4
Dec	15,207	67	2,181	6
Total	246,877	105	8,811	8

Building Energy Consumption = Source Energy Consumption =

99,146 (Btu/Sq Ft/Year) 100,713 (Btu/Sq Ft/Year)

Floor Area =

17,385 (Sq Ft)

2 Monthly KW = 950

UTILITY PEAK CHECKSUMS - ALTERNATIVE 3

Grand Total

•		UTILITY PEAK	CHE	CKSUNS
Utility	ELECTRIC DEM	IAND		
Peak Val	ue 104.7	(kW)		
Yearly T	ime of Peak 1	2 (hr) 7 (mo)		
Hour 12	Month 7			
Eqp.			Utility	Percnt
Ref.	Equipment		Demand	Of Tot
Num.	Code Name	Equipment Description	(kW)	(%)
Cooling	Equipment			
1	EQ1307.C	PACKAGED TERMINAL AIR CONDITIONER	1.6	1.56
2	EQ1172L	AIR-CLD COMD COMP >55 TONS	37.8	36.09
Sub Tota	t		39.4	37.64
Sub Tota	ŧ		0.0	0.00
Air Movi	ng Equipment			
3		SUMMATION OF FAN ELECTRICAL DEMAND	11.2	10.68
Sub Tota	ι		11.2	10.68
Sub Tota	ŧ		0.0	0.00
Miscella	neous			
Lights			50.2	47.97
Base Ut	ilities		0.0	0.00
Misc Eq			3.9	3.70
Sub Tota	l		54.1	51.67

104.7 100.00

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TRACE 600 ANALYSIS
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ESOS STUDY AT WSMR - BUILDING 21695 WHITE SANDS MISSILE RANGE NM US ARMY EMC ENGINEERS, INC. ENGINEERS, INC.
NEW BLDG AUDIT: ALT 1-BSLN, ALTZ-ECO (DRY-BULB ECONOMIZER ON AHU)

Weather File Code:	ELPASO	.v
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)
Design Simulation Period: May	To	October .
System Simulation Period: Jane	uary To	December

TETD/Time Averaging

Cooling Load Methodology:

Dataset Name:

System 1 Block RAD - RADIATION

Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Peaked at Time ==> Mo/Hr: 0/ 0 OADB: 24 0 CADB: Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 Percnt * Space Peak Coil Peak Percnt Net Percnt * Space Ret. Air Ret. Air Space Total Of Tot * Of Tot * Space Sens Tot Sens Sens.+Lat. Sensible Latent Sensible (%) * (Btuh) (%) (Btuh) (Btuh) (Btuh) (%) (Btuh) Envelope Loads (Btuh) (Btuh) 0.00 * 0 0.00 0 0 0 0.00 0 Skylite Solr 0 0.00 0 Ð 0.00 0 0.00 * n 0 Skylite Cond Λ 39.85 0.00 -5,421 -5,421 0 0.00 0 n Roof Cond 0 0 0 0.00 0.00 * 0 0.00 n 0 n Glass Solar 0.00 0 0 0.00 0.00 * 0 0 0 O Glass Cond 0.00 -5,251 -5,251 38.60 0 0.00 * 0 0 Wall Cond 0.00 * 0 G 0.00 0 0.00 * 0 n Partition -891 -891 6.55 n 0.00 0.00 Exposed Floor 0 Ω 0.00 * -2,039 -2.039 14.99 0.00 0 0 Infiltration 0.00 * -13,602 -13,602 100.00 0.00 0 0 0 Sub Total==> Internal Loads 0.00 * 0.00 * 0 0 0.00 Ω 0 Lights 0 0.00 * n 0 0.00 0.00 * 0 People 0 0.00 0 0.00 * n n 0.00 * Misc O 0 0 0.00 * 0 0.00 0.00 * 0 0 Sub Total ==> 0 0 O 0.00 * 0 0.00 0.00 * 0 0 0 0 Ceiling Load 0.00 * 0 0.00 0.00 * 0 0 Outside Air 0.00 0.00 * 0 0.00 * Sup. Fan Heat 0.00 * 0.00 0 0.00 * Ret. Fan Heat 0 0.00 0.00 * 0 0.00 * Duct Heat Pkup 0.00 * 0 n 0.00 * 0 OV/UNDR Sizing 0.00 0.00 * Ω 0 Exhaust Heat Λ 0.00 0.00 0.00 * Terminal Bypass -13,602 100.00 0.00 * -13,602 0.00 * 0 0 0 Grand Total ==> -----AREAS---------COOLING COIL SELECTION-----Gross Total Glass (sf) (%) Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR 880 (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor (Tons) 0 0.0 0.0 0.0 0.0 0.0 Part 0.0 0.0 0 0.0 Main Clg 0.0 0.0 0.0 0.0 ExFlr 27 0.0 0.0 Aux Clg 0.0 0.0 0.0 Ð 0.0 880 0 0.0 0.0 0.0 0.0 0.0 Roof Opt Vent 0.0 0.0 0.0 0 0.0 221 Wall Totals 0.0 -- ENGINEERING CHECKS---- TEMPERATURES (F)-------- AIRFLOWS (cfm)-----------HEATING COIL SELECTION-----Clg % OA 0.0 Type Clg Cooling Heating Capacity Coil Airfl Ent Lvg Type SADB 68.1 0.00 0.0 0 0 Clg Cfm/Sqft (Mbh) (cfm) Deg F Deg F Vent 68.0 0.0 0.0 0 48 Clg Cfm/Ton 0.00 Plenum Main Htg -12.1 0 0.0 Infil 0 Clg Sqft/Ton 0.00 Return 0.0 68.0 0.0 0.0 0 Aux Htg 0.0 0 Supply 0.0 68.0 0 0 Cla Btuh/Saft 0.00 Ret/OA 0 0.0 0.0 Preheat 0.0 Mincfm 0 No. People 0 0.0 68.0 0 Runarnd 0.0 ٥ 0.0 0.0 Return Reheat 0.0 0.0 0 Htg % CA 0.0 Fn MtrTD Humidif 0.0 0 0.0 0.0 Exhaust 0 Htg Cfm/SqFt 0.0 0.0 Rm Exh 0 0 0.00 Fn BldTD 0.0 0.0 0.0 Opt Vent -13.75 Fn Frict 0.0 -12.1 Auxil 0 Htg Btuh/SqFt Total

esperance.

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Total

0.0

System Peak PTAC - PACKAGED TERMINAL AIR COND. Mo/Hr: 7/16 Mo/Hr: 7/21 Mo/Hr: 0/ 0 Peaked at Time ==> Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 OADB: 85 OADB: 0 Net Percnt * Ret. Air Ret. Air Percnt * Space Space Space Peak Coil Peak Percnt Sens.+Lat. Sensible Latent Total Of Tot Sensible Of Tot * Space Sens Tot Sens Of Tot (Btuh) (Btuh) (Btuh) (%) Envelope Loads (Btuh) (Btuh) (%) (Btuh) (Btuh) (%) Skylite Solr 0 0 0.00 0 0.00 0 0 0 0.00 Skylite Cond 0.00 * 0 0 0 0.00 O 0 0 0.00 Roof Cond 4,682 0 4,682 35.14 6,172 48.80 * 0 0 0.00 Glass Solar 0 0.00 0.00 0 0 0 0 0 0.00 Glass Cond 0 0 0 0.00 0 0.00 0 0 0.00 48.49 * Wall Cond 0 2,220 2,220 16.66 6,134 0 0 0.00 Partition 0 0 0.00 * 0 0.00 * 0 0 0.00 Exposed Floor 0 0 0.00 * 0.00 * 0 0 0.00 Infiltration 1,067 8.01 2.71 1,067 343 0 0.00 Sub Total ==> 7,968 0 7,968 59.81 12,649 100.00 0 0 0.00 Internal Loads 3,604 Lights 3,604 0 27.05 ٥ 0.00 * 0 0 0.00 840 People 840 6.30 0 0.00 * 0 0 0.00 Misc 250 0 O 250 1.88 0 0.00 0 0 0.00 0.00 4,694 4,694 Sub Total==> O 35.23 0 Ω O 0.00 Ceiling Load 0 0 0.00 0 0.00 0 0 0.00 Outside Air n n n 661 4.96 n 0.00 * n n 0.00 Sup. Fan Heat n 0.00 0.00 * n 0.00 Ret. Fan Heat 0 0 0.00 0.00 * 0.00 Duct Heat Pkup 0.00 0.00 * 0.00 OV/UNDR Sizing 0.00 0.00 0 0.00 Exhaust Heat 0 0.00 0.00 Ω 0.00 Terminal Bypass n n 0.00 0.00 O 0.00 Grand Total ==> 12,662 0 0 13,323 100.00 * 12,649 100.00 0.00 -----COOLING COIL SELECTION-----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) (Mbh) (Tons) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 880 Main Cla 1.5 18.0 17.0 468 79.2 56.6 43.5 49.8 39.8 26.3 Part 0 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 27 ExFlr Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 880 0 Totals 1.5 18.0 Wall 221 0 -----AIRFLOWS (cfm)-------- ENGINEERING CHECKS---- TEMPERATURES (F)---Capacity Coil Airfl Ent Lvg Type Cooling Heating Clg % OA 6.4 Type Clg Htg (Mbh) (cfm) Deg F Deg F Vent 30 0 Clg Cfm/Sqft 0.53 SADB 49.8 0.0 Main Ktg -0.0 0 0.0 0.0 Infil 48 0 Clg Cfm/Ton 312.25 78.0 Plenum 0.0 Aux Htg 0.0 0 0.0 0.0 Supply 468 0 Clg Sqft/Ton 586.67 Return 78.0 0.0 Preheat -0.0 468 49.8 O ก 1.5 Mincfm Clg Btuh/Sqft 20.45 Ret/OA 79.2 0.0 Reheat 0.0 n 0.0 0.0 Return 468 Ω No. People 2 Runarnd 78.0 **Humidif** 0.0 0 0.0 0.0 **Exhaust** 30 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0 0.0 Rm Exh Htg Cfm/SqFt 0.00 Fn BldTD 0.0 0.0

0

Htg Btuh/SqFt

0.00

Fn Frict

0.0

0.0

Auxil

Ret/OA

Runarnd

Fn MtrTD

Fn BldTD

Fn Frict

37.16

20

9.6

1.32

-65.64

77.4

76.0

0.7

0.6

65.6

70.0

0.0

0.0

0.0

0.0

-0.0

0.0

0.0

0.0

-1,083.5

Aux Htg

Preheat

Reheat

Humidif

Opt Vent

Total

0

0

0

0

21,765

0.0

65.6

0.0

0.0

0.0

0.0

48.3

0.0

0.0

Supply

Mincfm

Return

Exhaust

Rm Exh

Auxil

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- SINGLE ZONE System 3 Peak **S7** Mo/Hr: 13/ 1 Mo/Hr: 7/20 Peaked at Time ==> Mo/Hr: 7/17 OADB: 24 OADB: 88 QADB/WB/HR: 96/ 63/ 49.0 Outside Air ==> Coil Peak Percnt * Space Peak Percnt Ret. Air Ret. Air Space Net Percnt Space Space Sens Tot Sens Of Tot Of Tot * Of Tot Sensible Total Sens.+Lat. Sensible Latent (Btuh) (%) (%) * (Btuh) (Btuh) (Btuh) (%) Envelope Loads (Btuh) (Btuh) (Btuh) 0 0.00 n 0.00 * 0 0.00 Ω 0 0 Skylite Solr n 0.00 0.00 * O 0 0 0 0 0.00 Skylite Cond -106,293 -106,293 15.11 20.79 * 110,219 113,013 0 113,013 18.43 Roof Cond 1.30 * 0.00 6,889 n 6,889 1.12 6,889 Glass Solar 1.53 -10,783 -10,783 0.85 4,500 4,500 0.73 4,500 0 Glass Cond -378,688 -378,688 53.84 54.12 340,490 64.23 331,977 331,977 0 Wall Cond 0.00 0 0.00 0 0.00 0 0 Partition 0.00 -27,565 -27,565 3.92 0 Ω 0.00 Exposed Floor 0 -120,605 -120,605 17.15 6.52 5.83 30,916 40,003 40,003 Infiltration -643,935 91.56 -643,935 93.00 80.93 493,014 496,382 496,382 0 Sub Total ==> Internal Loads 0.00 24,587 4.64 0 24,587 4.01 24,587 Lights 0.00 2,300 0.43 0 0.68 4,200 4,200 People 0.00 10,244 1.93 0 0 0 10,244 1.67 10,244 Misc 0.00 37,131 7.00 39,031 6.36 39,031 0 Sub Total ==> 0.00 * 0.00 0.00 0 0 0 0 Ceiling Load 0.00 * -91,702 13.04 31,513 5.14 O 0 0 Outside Air 32,337 -4.60 0.00 46,432 7.57 Sup. Fan Heat 0.00 0.00 0 0 0.00 0 Ret. Fan Heat 0.00 0.00 O 0 0.00 Duct Heat Pkup 0.00 0 0.00 0 0.00 OV/UNDR Sizing 0.00 0.00 0 0.00 0 0 Exhaust Heat 0.00 0 0.00 0.00 0 0 Terminal Bypass 100.00 -703,300 100.00 -643,935 613,359 100.00 * 530,146 535,413 Grand Total==> ------AREAS-----------COOLING COIL SELECTION-----Glass (sf) (%) Gross Total Leaving DB/WB/HR Entering DB/WB/HR Total Capacity Sens Cap. Coil Airfl 16,505 Deg F Grains Floor Deg F (cfm) Deg F Deg F Grains (Mbh) (Mbh) (Tons) 9,725 41.3 Part 77.4 55.7 42.3 48.3 43.6 604.7 21,765 613.4 Main Clg 51.1 799 ExFlo 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Aux Clg 0.0 16,505 0.0 0.0 0.0 Roof 0 0.0 0.0 0.0 0.0 0.0 0.0 Opt Vent 12,959 186 Wall Totals 51.1 613.4 -- TEMPERATURES (F)----- ENGINEERING CHECKS-------HEATING COIL SELECTION---------- AIRFLOWS (cfm)-----Clg Htg 9.6 Type Clg % OA Heating Cooling Capacity Coil Airfl Ent Lvg Type 50.6 100.9 SADB Clg Cfm/Sqft 1.32 2,082 2,082 (Mbh) (cfm) Deg F Deg F Vent 76.0 70.0 425.82 Plenum 2,738 Clg Cfm/Ton 98.7 Infil 2,738 -1,083.5 21,765 46.7 Main Htg 76.0 70.0 322.91 Return Clg Sqft/Ton 21,765

21,765

21.765

2,082

0

0

0

0

0

0

21,765

2,082

Clg Btuh/Sqft

Htg Cfm/SqFt

Htg Btuh/SqFt

No. People

Htg % OA

BUILDING U-VALUES - ALTERNATIVE 4
DRY BULB ECONOMIZER ON AHU - BLDG 21695

------ BUILDING U-VALUES -----

Room U-Values										Room	Room	
					(Btu	/hr/sqf	t/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	2 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
2	RM 2 - OFFICES	0.388	0.750	0.000	0.000	0.140	1.140	1.259	0.417	0.000	88.7	18.64
Zone	2 Total/Ave.	0.388	0.750	0.000	0.000	0.140	1.140	1.259	0.417	0.000	88.7	18.64
3	RM 3 - HIGH BAY	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
Zone	3 Total/Ave.	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
System	3 Total/Ave.	0.658	0.750	0.000	0.000	0.140	1.140	1.259	0.645	0.000	110.3	22.96
Buildin	ng .	0.658	0.750	0.000	0.000	0.140	1.140	1.259	0.641	0.000	106.9	22.28

BUILDING AREAS - ALTERNATIVE 4
DRY BULB ECONOMIZER ON AHU - BLDG 21695

------ BUILDING AREAS ------

Room		Dupl	er of icate	Floor Area/Dupl Room	Total Floor Area	Partition Area	Exposed Floor Area	Skylight Area	Skl /Rf	Net Roof Area	Window Area	/Wl	Net Wall Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	0	880	0	0	221
System	1 Total/Ave.				880	0	27	0	0	880	0	0	221
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	0	880	0	0	221
System	2 Total/Ave.				880	0	27	0	0	880	0	0	221
2	RM 2 - OFFICES	1	1	6,003	6,003	2,475	265	0	0	6,003	186	6	2,729
Zone	2 Total/Ave.				6,003	2,475	265	0	0	6,003	186	6	2,729
3	RM 3 - HIGH BAY	1	1	10,502	10,502	7,250	534	0	0	10,502	0	0	10,044
Zone	3 Total/Ave.				10,502	7,250	534	0	0	10,502	0	0	10,044
System	3 Total/Ave.				16,505	9,725	799	0	0	16,505	. 186	1	12,773
Buildin	g				18,265	9,725	853	0	0	18,265	186	1	13,215

System Totals

Percent	Cool	ing Loa	d	Heati	ng Load		Cooling	Airflow		Heating	Airflow	00000
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	2.6	8	315	-54,778	11	316	1,111.7	0	0	0.0	0	0
5 ~ 10	5.3	8	323	-109,556	17	513	2,223.3	0	0	0.0	0	0
10 - 15	7.9	7	288	-164,334	17	506	3,335.0	0	0	0.0	0	0
15 - 20	10.5	5	205	-219,112	16	480	4,446.7	0	0	0.0	0	0
20 - 25	13.2	5	205	-273,890	13	398	5,558.4	0	0	0.0	0	0
25 - 30	15.8	4	176	-328,668	12	345	6,670.0	0	0	0.0	0	0
30 - 35	18.4	5	189	-383,446	8	232	7,781.7	0	0	0.0	0	0
35 - 40	21.0	5	179	-438,224	4	127	8,893.4	0	0	0.0	0	0
40 - 45	23.7	5	213	-493,002	1	39	10,005.1	0	0	0.0	0	0
45 - 50	26.3	9	362	-547,780	0	0	11,116.7	0	0	0.0	0	0
50 - 55	28.9	6	218	-602,558	0	0	12,228.4	0	0	0.0	0	0
55 - 60	31.6	8	324	-657,336	0	0	13,340.1	0	0	0.0	0	0
60 - 65	34.2	2	90	-712,114	0	0	14,451.8	0	0	0.0	0	0
65 - 70	36.8	4	175	-766,892	0	0	15,563.4	0	0	0.0	0	0
70 - 75	39.5	6	228	-821,670	0	0	16,675.1	0	0	0.0	0	0
75 - 80	42.1	5	186	-876,448	0	0	17,786.8	0	0	0.0	0	0
80 - 85	44.7	5	186	-931,226	0	0	18,898.4	0	0	0.0	0	0
85 - 90	47.4	2	62	-986,004	0	0	20,010.1	0	0	0.0	0	0
90 - 95	50.0	1	31	-1,040,782	0	0	21,121.8	0	0	0.0	0	0
95 - 100	52.6	0	0	-1,095,560	0	0	22,233.5	100	8,760	0.0	0	0
Hours Off	0.0	0	4,805	0	0	5,804	0.0	0	0	0.0	0	8,760

------ MONTHLY ENERGY CONSUMPTION -----

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	15,865	69	2,919	8
Feb	14,286	69	2,242	7
March	15,525	69	577	4
April	14,629	67	0	0
May	23,104	91	0	0
June	30,182	103	0	0
July	35,069	107	0	0
Aug	33,856	104	0	0
Sept	23,477	91	0	0
Oct	15,843	67	0	0
Nov	14,508	69	807	4
Dec	15,559	69	2,150	6
Total	251,904	107	8,696	8

Building Energy Consumption = Source Energy Consumption =

99,474 (Btu/Sq Ft/Year) 101,021 (Btu/Sq Ft/Year)

EMonthly KW = 975

Floor Area = 17,385 (Sq Ft)

------UTILITY PEAK CHECKSUMS-----

Utility ELECTRIC DEMAND

Peak Value 107.3 (kW)
Yearly Time of Peak 12 (hr) 7 (mo)

Hour 12 Month 7

independent in

	•			
Eqp.			Utility	
Ref.	Equipment		Demand	Of Tot
Num.	Code Name	Equipment Description	(kW)	(%)
Cooling E	quipment			
1	EQ1307.C	PACKAGED TERMINAL AIR CONDITIONER	1.6	1.52
2	EQ1172L	AIR-CLD COND COMP >55 TONS	38.4	35.81
Sub Total			40.0	37.33
Sub Total			0.0	0.00
Air Movin	g Equipment			
3		SUMMATION OF FAN ELECTRICAL DEMAND	11.2	10.43
Sub Total			11.2	10.43
Sub Total			0.0	0.00
Miscellan	eous			
Lights			52.2	48.63
Base Uti	lities		0.0	0.00
Misc Equ	ıipment		3.9	
Sub Total			56.0	52.24
Grand Tot	:al		107.3	100.00

TRACE 600 ANALYSIS bv

ESOS STUDY AT WSMR - BUILDING 21695 WHITE SANDS MISSILE RANGE NM US ARMY EMC ENGINEERS, INC. NEW BLDG AUDIT: ALTS - BOLN, (ALTZ-ECO) TEMPERATURE SETBACK

Weather File Code: ELPASO.W

Location:

Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation:

3,918 (ft) Barometric Pressure: 25.8 (in. Hg)

Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F)

Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

0.0653 (Lbm/cuft) Air Density: Air Specific Heat: 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft) Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 10:43:55 3/14/92

Dataset Name: 21695A .TM 1 gara, 1983 118

System Block RAD - RADIATION Mo/Hr: 0/ 0 Peaked at Time ==> Mo/Hr: 0/ 0 Mo/Hr: 13/ 1 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 OADB: 0 OADB: 24 Space Ret. Air Ret. Air Net Percnt Space Percnt * Space Peak Coil Peak Percnt Sens.+Lat. Sensible Latent Total Of Tot Sensible Of Tot * Space Sens Tot Sens Of Tot Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) (%) (%) * (Btuh) (Btuh) (Btuh) (%) Skylite Solr 0 0 O 0.00 Ω 0.00 * 0 0 0.00 Skylite Cond 0 0 Ω 0.00 0 0.00 * 0 0 0.00 Roof Cond 0 Λ 0 0.00 0.00 * -5,421 -5,421 39.85 Glass Solar n n 0.00 0.00 * 0 0 0.00 Glass Cond 0 0 0 0.00 0 0.00 * 0 0 0.00 Wall Cond 0.00 * Ω 0 0.00 * -5.251 -5,251 38.60 Partition 0 0 0.00 * 0 0.00 0 0 0.00 Exposed Floor 0 0.00 0 0.00 -891 -891 6.55 Infiltration 0 0.00 0.00 * Λ -2,039 -2,039 14.99 Sub Total ==> 0 0.00 * n 0 0.00 * -13,602 -13,602 100.00 Internal Loads Lights n O 0 0.00 * 0.00 * 0 0 0 0.00 People 0 0.00 * 0 0 0.00 0 0 0.00 Misc 0 0 0 0.00 * 0 0 0.00 0 0 0.00 Sub Total==> 0 0 Û 0 0.00 * 0 0.00 0 n 0.00 Ceiling Load O 0 0 0.00 0 0.00 Λ 0.00 Outside Air 0 0 0 0 0.00 0.00 * 0 Ω 0.00 Sup. Fan Heat 0 0.00 0.00 * 0.00 Ret. Fan Heat 0 0 0.00 * 0.00 * 0.00 Duct Heat Pkup ٥ 0 0.00 * 0.00 * n 0.00 OV/UNDR Sizing 0 0.00 * 0.00 Ω Ω Exhaust Heat 0 0.00 0.00 Terminal Bypass 0.00 0.00 * 0.00 Grand Total ==> 0.00 * 0.00 * -13,602 -13,602 100.00 -----COOLING COIL SELECTION----------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR **Gross Total** Glass (sf) (%) (Tons) (Mbh) (Mbh) (cfm) Deg F Deg F Grains Deg F Deg F Grains Floor 880 Main Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 Part 0 Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Exflr 27 Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 880 0 0 Totals 0.0 0.0 Wall 221 ------HEATING COIL SELECTION----------AIRFLOWS (cfm)------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Ent Lvg Type Cooling Heating Clg % OA 0.0 Type Clg (Mbh) (cfm) Deg F Deg F Vent 0 0 Clg Cfm/Sqft 0.00 SADB 0.0 68.1 Main Ktg -12.1 0 0.0 0.0 Infil 0 48 Clg Cfm/Ton 0.00 Plenum 0.0 68.0 Aux Htg 0.0 0 0.0 0.0 Supply n 0 Clg Sqft/Ton 0.00 Return 0.0 68.0 Preheat 0.0 0 0.0 0.0 Mincfm 0 0 Clg Btuh/Sqft 0.00 Ret/OA 0.0 68.0 Reheat 0.0 0 0.0 0.0 Return 0 0 No. People 0 Runarnd 0.0 68.0 Humidif 0.0 0 0.0 0.0 Exhaust 0 0 Htg % OA 0.0 Fn MtrTD 0.0 0.0 Opt Vent 0.0 0.0 Rm Exh n 0 Htg Cfm/SqFt 0.00 Fn BldTD 0.0 0.0 Total -12.1 Auxil Htg Btuh/SqFt -13.75 Fn Frict 0.0

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System	2	Peak	PTAC	- PACKAG	ED TERMINAL	AIR COND	•						
*****	*****	*****	COOLING COIL	_ PEAK ****	******	*****	****** C	LG SPAC	E PEAK ****	****** H	EATING COL	PEAK	******
Peaked	at Time	==>	Mo/Hr:						7/21	*	Mo/Hr:		
Outside	Air ==>	0	ADB/WB/HR:	97/ 64/ 49	.0		*	OADB:		*	OADB:	0	
		_					*			*			
		Space			Net	Percnt	*	Space	Percnt	* Space	Peak Coil	Peak	Percnt
		Sens.+Lat.	Sensible		Total		* Se	nsible	Of Tot	* Space	Sens Tot	Sens	Of Tot
Envelop		(Btuh)	(Btuh)		(Btuh)	(%)	*	(Btuh)	(%)	* (B	tuh) ((Btuh)	(%)
	te Solr	0			0	0.00	*	0	0.00	*	0	0	0.00
-	te Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof (4,682	0	1	4,682	35.14	*	6,172	48.80	*	0	0	0.00
	Solar	0	0	1	0	0.00	*	0	0.00	*	0	0	0.00
Glass		0	0	†	0	0.00	*	0	0.00	ŧ	0	0	0.00
Wall (Cond	2,220	0	1	2,220	16.66	*	6,134	48.49	*	0	0	0.00
Partii	tion	0			0	0.00	*	0	0.00	k	0	0	0.00
•	ed Floor	0			0	0.00	*	0	0.00	k	0	0	0.00
Infilt	tration	1,067			1,067	8.01	*	343	2.71		0	0	0.00
Sub To	otal==>	7,968	0		7,968	59.81	* 1	2,649	100.00		0	0	0.00
Internal	Loads				•		*			+	•	•	0.00
Lights	S	3,604	0		3,604	27.05	*	0	0.00	r	0	0	0.00
People	.	840			840	6.30	*	0	0.00		0	0	0.00
Hisc		250	0	0	250	1.88	*	o	0.00		0	0	
Sub To	tal==>	4,694	0		4,694	35.23	*	0	0.00		0	0	0.00
Ceiling	Load	0	0	•	0	0.00	*	. 0	0.00		0	•	0.00
Outside		0	. 0.	0	661		*	0	0.00 *		0	0	0.00
Sup. Fan					0	0.00	*	U			U	0	0.00
Ret. Fan			0		0	0.00	*		****	•		0	0.00
Duct Hea			0		0	0.00	*		0.00 *			0	0.00
OV/UNDR		0	v		0		•	•	0.00 *		_	0	0.00
Exhaust	_	v	0	0		0.00	_	0	0.00 *		0	0	0.00
Terminal			0	0	0		*		0.00 *			0	0.00
101111111111111111111111111111111111111	Б уразз		U	U	0	0.00	*		0.00 *			0	0.00
Grand To	tal==>	12,662	0	0	13,323	100.00	* 1	2,649	100.00 *		0	0	0.00
			cool	ING COIL S	ELECTION				••••		AREAS-		
	Total	Capacity	Sens Cap.			g DB/WB/I	íR Le	avina D	B/WB/HR	Gross To		ss (sf	\ (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)		F Grain		_	Grains	Floor	880	155 (51,	, (~)
Main Clg	1.5	18.0	17.0	468	79.2 56		-	39.8		Part	0		
Aux Clg	0.0	0.0	0.0	0		.0 0.		0.0					
Opt Vent	0.0	0.0	0.0	0		.0 0.		0.0		ExFlr	27		
Totals	1.5	18.0					0.0	0.0	0.0	Roof Wall	880 221		0 0
	HEATIN	IG COIL SELE	CTION		AIR	FLOWS (cf	m)	1	ENGINEERING	CHECKS"-	TEMOED	ATURER	45 \
	Capacit			Lvg		Cooling	"", Heating		g % OA		TEMPER		
	(Mbh)	-		Deg F	Vent	30	neat my		g Cfm/Sqft	6.4	Type	Clg	Htg
Main Htg	-0.	•	0 0.0	0.0	Infil	48			•	0.53	SADB	49.8	0.0
Aux Htg	0.		0.0	0.0	Supply		-		Cfm/Ton	312.25	Plenum	78.0	0.0
Preheat	-0.		68 1.5			468	0		Sqft/Ton	586.67	Return	78.0	0.0
Reheat	0.		0 0.0	0.0	Mincfm	0	0	•	Btuh/Sqft	20.45	Ret/OA	79.2	0.0
Humidif	0.		0.0		Return	468	0		People	2	Runarnd	78.0	0.0
Opt Vent	0.				Exhaust	30	0		% OA	0.0	Fn MtrTD	0.0	0.0
Total			0.0	0.0	Rm Exh	0	0		Cfm/SqFt	0.00	Fn BldTD	0.0	0.0
ivial	0.	U			Auxil		0	Htg	Btuh/SqFt	0.00	Fn Frict	0.0	0.0

Peak

SZ

- SINGLE ZONE

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System

notes de la constante de la co

Peaked a	t Time =	=>	Mo/Hr:	7/17			*	Mo/Hr:	7/20	*	Mo/H	ir: 13/ 1	
Outside /	Air ==>	OA	DB/WB/HR:	96/ 63/ 49.	0		*	OADB:	88	*	OAD	B: 24	
		Snaaa	Dot Air	Dot Ain	No	t Donamt	*	Cnass	Percnt 1	k K Smaaa	Dook C	ed Deak	0
		Space Sens.+Lat.	Sensible	Ret. Air	Ne Tota	t Percnt l Of Tot	* 6	Space ensible	Of Tot	-		oil Peak Tot Sens	Percni Of Tot
Envelope		(Btuh)	(Btuh)		(Btuh		*	(Btuh)	(%)	•	sens Ituh)	(Btuh)	
Skylite		(6(01)	(Bruin)		-	0.00		(BLUII) 0	0.00	•-	0	(BLUII)	0.0
Skylite		0	0			0.00		0	0.00		0	0	0.0
Roof Co		113,013	0		113,01			10,219	20.79			-106,293	15.11
Glass S		6,889	0		6,889			6,889	1.30 1		0	0	0.00
Glass (4,500	0		4,50			4,500	0.85		,783	-10,783	1.53
Wall Co		331,977	0		331,97			40,490	64.23		•	-378,688	53.84
Partiti		331,777	•		-	0.00		0	0.00		0	-370,000	0.0
								-				-	
Exposed		(0.007				0.00		0	0.00		,565	-27,565	3.92
Infiltr		40,003	•		40,003			30,916	5.83		-	-120,605	17.15
Sub Tot		496,382	0		496,382	2 80.93	* 4	93,014	93.00	-643	,935	-643,935	91.56
Internal	Loads		2								_	_	
Lights		24,587	0		24,587			24,587	4.64		0	0	0.00
People		4,200	_	_	4,200			2,300	0.43		0	0	0.00
Misc		10,244	0	_	10,244			10,244	1.93		0	0	0.00
Sub Tot		39,031	0		39,031			37,131	7.00		0	0	0.00
Ceiling L		0	0		(0	0.00		0	0	0.00
Outside A		0	0	0	31,513			0	0.00		0	-91,702	13.04
Sup. Fan			_		46,432				0.00			32,337	-4.60
Ret. Fan			0		C				0.00			0	0.00
Duct Heat	•		0		C				0.00			0	0.00
OV/UNDR S	-	0	_	_	C			0	0.00		0	0	0.00
Exhaust H			0		C				0.00 *	1		0	0.00
Terminal	Bypass		0	0	0	0.00	*		0.00 *	1		0	0.00
			_				*		*				
Grand Tot	:al==>	535,413	0	0	613,359	100.00	* 5	30,146	100.00 *	-643	,935 -	-703,300	100.00
			cool	LING COIL SE	LECTION						ARE	EAS	
	Total	Capacity	Sens Cap.	Coil Airfl	Enteri	ng DB/WB/	HR L	eaving (OB/WB/HR	Gross To	otal	Glass (sf	f) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	g F Grai	ns Deg	F Deg I	F Grains	Floor	16,505		
ain Clg	51.1	613.4	604.7	21,765	77.4 5	5.7 42	.3 48.	3 43.6	41.3	Part	9,725		
ux Clg	0.0	0.0	0.0	0	0.0	0.0 0	.0 0.0	0.0	0.0	ExFlr	799		
pt Vent	0.0	0.0	0.0	0	0.0	0.0 0.	.0 0.0	0.0	0.0	Roof	16,505		0 0
otals	51.1	613.4								Wall	12,959	1	186 1
	UEATIN	c coll cels	NOITO			DELOUE CO	6m\		ENCINEEDING	CHECKG		4050 A TI IDEC	
	Capacit				Tyma				·ENGINEERING lg % OA			(PERATURES	
	(Mbh)	-		Lvg	Type	Cooling	Heating		=	9.6	Тур		Htg
ain Htg	-1,083.		-	Deg F 98.7	Vent Infil	2,082 2,738	2,08 2,73		lg Cfm/Sqft lg Cfm/Ton	1.32	SADB	50.6	
ux Htg	0.	=	0 0.0		Supply	2,730	21,76		-	425.82	Plenu		
wn Htg	-0.						21,70		lg Sqft/Ton	322.91	Retur		
rahast	-0.	•	0.0		Mincfm	0 21 745	21,76		lg Btuh/Sqft		Ret/O		
	Δ.				Return	21,765	21.70	או עכ	. People	20	Runar	nd 76.0	70.0
eheat	0. 0					-	-		•				
reheat eheat umidif pt Vent	0.: 0.: 0.:	0	0 0.0	0.0	Exhaust Rm Exh	2,082 0	2,08	32 Ht	g % OA g Cfm/SqFt	9.6 1.32	Fn Mt Fn Bl	:rTD 0.7	0.0

BUILDING U-VALUES - ALTERNATIVE 1 ECO - NIGHT SETBACK - BLDG 21695

------ BUILDING U-VALUES------

		Room U-Values								Room	Room	
					(Btu	i/hr/sqf	ft/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
1	RM 1 - STORAGE	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
System	2 Total/Ave.	0.000	0.750	0.000	0.000	0.140	0.000	0.000	0.540	0.000	75.2	15.93
2	RM 2 - OFFICES	0.388	0.750	0.000	0.000	0.140	1.140	1.259	0.417	0.000	88.7	18.64
Zone	2 Total/Ave.	0.388	0.750	0.000	0.000	0.140	1.140	1.259	0.417	0.000	88.7	18.64
3	RM 3 - HIGH BAY	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
Zone	3 Total/Ave.	0.750	0.750	0.000	0.000	0.140	0.000	0.000	0.706	0.000	122.7	25.43
System	3 Total/Ave.	0.658	0.750	0.000	0.000	0.140	1.140	1.259	0.645	0.000	110.3	22.96
Buildin	g	0.658	0.750	0.000	0.000	0.140	1.140	1.259	0.641	0.000	106.9	22.28

BUILDING AREAS - ALTERNATIVE 1 ECO - NIGHT SETBACK - BLDG 21695

BUILDING AREAS -----

Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	0	880	0	0	221
System	1 Total/Ave.				880	0	27	0	0	880	0	0	221
1	RM 1 - STORAGE	1	1	880	880	0	27	0	0	880	0	0	221
Zone	1 Total/Ave.				880	0	27	0	0	880	0	0	221
System	2 Total/Ave.				880	0	27	0	0	880	0	0	221
2	RM 2 - OFFICES	1	1	6,003	6,003	2,475	265	0	0	6,003	186	6	2,729
Zone	2 Total/Ave.				6,003	2,475	265	0	0	6,003	186	6	2,729
3	RM 3 - HIGH BAY	1	1	10,502	10,502	7,250	534	0	0	10,502	0	0	10,044
Zone	3 Total/Ave.				10,502	7,250	534	0	0	10,502	0	0	10,044
System	3 Total/Ave.				16,505	9,725	799	0	0	16,505	186	1	12,773
Buildin	g				18,265	9,725	853	0	0	18,265	186	1	13,215

System Totals

Percent	Cool	ing Loa	d	Heati	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Kours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	2.6	10	223	-54,778	20	252	1,111.7	0	0	0.0	0	0
5 - 10	5.3	12	279	-109,556	14	176	2,223.3	0	0	0.0	0	0
10 - 15	7.9	6	125	-164,334	12	153	3,335.0	0	0	0.0	0	0
15 - 20	10.5	6	125	-219,112	18	239	4,446.7	0	0	0.0	0	0
20 - 25	13.2	4	93	-273,890	9	119	5,558.4	0	0	0.0	0	0
25 - 30	15.8	4	80	-328,668	7	96	6,670.0	0	0	0.0	0	0
30 - 35	18.4	3	73	-383,446	1	11	7,781.7	0	0	0.0	0	0
35 - 40	21.0	4	88	-438,224	2	27	8,893.4	0	0	0.0	0	0
40 - 45	23.7	6	145	-493,002	0	0	10,005.1	0	0	0.0	0	0
45 - 50	26.3	8	185	-547,780	3	41	11,116.7	0	0	0.0	0	0
50 - 55	28.9	6	140	-602,558	1	16	12,228.4	0	0	0.0	0	0
55 - 60	31.6	3	71	-657, 33 6	0	3	13,340.1	0	0	0.0	0	0
60 - 65	34.2	4	82	-712,114	1	8	14,451.8	0	0	0.0	0	0
65 - 70	36.8	5	117	-766,892	9	110	15,563.4	0	0	0.0	0	0
70 - 75	39.5	4	79	-821,670	2	27	16,675.1	0	0	0.0	0	0
75 - 80	42.1	4	89	-876,448	• 1	10	17,786.8	0	0	0.0	0	0
80 - 85	44.7	1	20	-931,226	0	4	18,898.4	0	0	0.0	0	0
85 - 90	47.4	0	0	-986,004	0	0	20,010.1	0	0	0.0	0	0
90 - 95	50.0	0	0	-1,040,782	0	0	21,121.8	0	0	0.0	0	0
95 - 100	52.6	10	235	-1,095,560	0	0	22,233.5	100	8,760	0.0	0	0
Hours Off	0.0	0	6,511	0	0	7,468	0.0	0	0	0.0	0	8,760

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MONTHL	YENERGY	CONSUMPTION	
11 0 11 11 15			

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	14,909	69	1,620	14
Feb	13,429	69	1,248	13
March	15,294	69	346	11
April	14,201	67	0	0
May	19,148	91	0	0
June	23,852	103	0	0
July	26,429	107	0	0
Aug	26,205	104	0	0
Sept	18,494	91	0	0
0ct	14,979	67	0	0
Nov	14,154	69	454	11
Dec	14,549	69	1,099	13
Total	215,642	107	4,767	14

Building Energy Consumption = Source Energy Consumption =

69,757 (Btu/Sq Ft/Year) 70,605 (Btu/Sq Ft/Year)

Floor Area = 17,385 (Sq Ft)

Z Monthly kw = 975

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

------UTILITY PEAK CHECKSUMS-----

Utility ELECTRIC DEMAND

Peak Value 107.3 (kW)
Yearly Time of Peak 12 (hr) 7 (mo)

Hour 12 Month 7

3520202949294925282

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling E	quipment			
1 2	EQ1307.C EQ1172L	PACKAGED TERMINAL AIR CONDITIONER AIR-CLD COND COMP >55 TONS	1.7 38.4	1.55 35.79
Sub Total			40.1	37.34
Sub Total			0.0	0.00
Air Movin	g Equipment			
3		SUMMATION OF FAN ELECTRICAL DEMAND	11.2	10.43
Sub Total			11.2	10.43
Sub Total			0.0	0.00
Miscelland	eous			
Lights Base Util Misc Equi Sub Total			52.2 0.0 3.9 56.0	48.61 0.00 3.62 52.23
Grand Tota	al		107.3	100.00

D16-46

		LOCATION: White	te Sands Missil	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	BLDG. 21695	- MOD. CONFIG. (ECO	LIGHTING; SETBACK	(T-STAT)	FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/22/92		ECONOMIC LIFE:	15	PREPARED BY:	A. NIEMEYER
	IMN	/ESTMENT						
•		CONSTRUCTION	COST	=			\$4.205	
		SIOH COST	0031	_			\$4,395	
		DESIGN COST		(5.5% of 1A) =			\$242	
				(6.0% of 1A) =			\$264	
	D. E.	ENERGY CREDIT SALVAGE VALUE		(1A + 1B + 1C) =			\$4,901	
		TOTAL INVESTME	:NIT	(1D - 1E) =			\$0	#4 004
	۲.	TOTAL INVESTIGE	.14 1	(10 - 12) =			>	\$4,901
2	EN	ERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	142	\$921	10.79	\$9,936	
	В.	DIST		0	\$0	11.57	\$0	
	C.	NAT GAS	\$2.21	385	\$852	12.38	\$10,542	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	11.35	\$0	
	F.	TOTAL		. 527	1,772.4		>	\$20,478
3	NO	N-ENERGY SAVIN	GS (+) / COST	(-)				
	A.	ANNUAL RECURF	IING (+/-) (ELE	C. DEMAND SAVINGS)	=		\$488	
		1 DISCOUNT FAC	•		(From Table A-2) =	10.67		
	_	2 DISCOUNTED S		COST (-)	(3A x 3A1) =		\$5,202	
	В.	NON-RECURRING	3 (+/−)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c. d TOTAL		\$0		0.00	\$0	
	c		DOV DISCOUR	\$0 TED SAVINGS (+) / COS	XT ()	(040 : 0044)	\$0	47 44
		PROJECT NON-E		TED SAVINGS (+) / COS) (-)	(3A2 + 3Bd4) =		\$5,202
	٠.	1 25% MAXIMUM		Y CALCULATION		(2F5 x 0.33) =	\$6,758	
		a IF 3D1 => 3C 7				(21 5 x 0.55) =	ψ0,738	
		b IF 3D1 < 3C T				(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T	HEN GO TO 4			(=: -: -: -: -: -: -: -: -: -: -: -: -: -:		
				DOES NOT QUALIFY				
		IST YEAR DOLLAR		, ,	(2F3	+ 3A + (3B1d/25)) =		\$2,260
		TAL NET DISCOUN				(2F5 + 3C) =		\$25,680
6				TMENT RATIO (SIR)		(5/1F) =		5.24
_		SIR < 1 THEN PRO		NOT QUALIFY)				
′	211/	MPLE PAYBACK (SP	'B)			(1F/4) =		2.17

		LOCATION: Whi	te Sands Missile	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	BLDG. 21695	- SETBACK/SETUP THE	ERMOSTAT (MODIFIEI	CONFIG.)	FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/19/92		ECONOMIC LIFE:	15	PREPARED BY:	A. NIEMEYER
1	IN۱	/ESTMENT						
	A.	CONSTRUCTION	COST	=			\$138	
	В.	SIOH COST		(5.5% of 1A) =			\$7	
	C.	DESIGN COST		(6.0% of 1A) =			\$8	
	D.	ENERGY CREDIT		(1A+1B+1C)=			\$152	
	E.	SALVAGE VALUE		•			\$0	
	F.	TOTAL INVESTME	ENT	(1D - 1E) =			>	\$152
,	EM	ERGY SAVINGS (+)	/COST (_)					
_		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	122	\$792	10.79	\$8,551	
	В.	DIST		0	\$0	11.57	\$0	
	C.	NAT GAS	\$2.21	390	\$862	12.38	\$10,671	
	D.	PAPER			\$0		\$0	
	E.	COAL			\$0	11.35	\$0	
	F.	TOTAL		512	1,654.4		>	\$19,222
_								
		N-ENERGY SAVIN		•			(450)	
	Α.	1 DISCOUNT FAC		CT. DEMAND SAVINGS)	(Erom Toble A 2)	10.67	(\$59)	
		2 DISCOUNTED S		OST (_)	(From Table A-2) ≠ (3A x 3A1) =	10.67	(¢ @2.4\	
	B.	NON-RECURRING	• •	031 (-)	(3A X 3A1) =		(\$624)	
	-	ITEM	- ('')		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0	(.,	0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENE	RGY DISCOUN	TED SAVINGS (+) / COS	T (–)	(3A2 + 3Bd4) =		(\$624)
	D.	PROJECT NON-E	NERGY TEST					
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$6,343	
		a IF 3D1 => 3C 1						
		b IF 3D1 < 3C Th		TE SIR		(2F5 + 3D1) / 1F =		
		c IF 3D1b => 1 T						
		d IF 3D1b < 1 TF	IEN PROJECT	DOES NOT QUALIFY				
4	FIR	ST YEAR DOLLAR	SAVINGS (+) / (COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$1,596
5	TO [*]	TAL NET DISCOUN	TED SAVINGS			(2F5 + 3C) =		\$18,598
6	DIS	COUNTED SAVING	is-to-invest	MENT RATIO (SIR)		(5/1F) =		122.44
		SIR < 1 THEN PRO		OT QUALIFY)				
7	SIM	IPLE PAYBACK (SP	B)			(1F/4) =		0.10

		LOCATION: Whi	e Condo Missil	a Panga	DECION:	•	PRO IECT NO	D404 00 04 0 04F0
		LOCATION: White		•	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				RGY EFFICIENT LIGHTI	NG (MODIFIED CONFI	G.)	FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/19/92		ECONOMIC LIFE:	25	PREPARED BY:	A. NIEMEYER
1	INI	VESTMENT						
•		CONSTRUCTION	COST	_			\$4,259	
		SIOH COST	0001	(5.5% of 1A) =			\$234	
		DESIGN COST		(6.0% of 1A) =			\$256	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$4,748	
		SALVAGE VALUE		(12+15+10)=		•	\$0	
		TOTAL INVESTME	:NIT	(1D - 1E) =			•	¢4.740
	•	TOTAL INVESTIGE	.141	(10 - 12) =			>	\$4,748
2	EN	ERGY SAVINGS (+)	/COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	29	\$189	15.23	\$2,873	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	377	\$834	19.64	\$16,381	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		406	1,022.7		>	\$19,254
					,			******
3	NC	N-ENERGY SAVIN	GS (+) / COST	(-)				
				C. DEMAND SAVINGS)	=		\$488	
		1 DISCOUNT FAC		•	(From Table A-2) =	14.68	•	
		2 DISCOUNTED S	SAVINGS (+) / C	COST (-)	(3A x 3A1) =		\$7,157	
	В.	NON-RECURRING	3 (+/-)		•			
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0	.,,	0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENE	RGY DISCOUN	NTED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$ 7,157
	D.	PROJECT NON-E	NERGY TEST			,		. ,
		1 25% MAXIMUM	NON-ENERG'	Y CALCULATION		(2F5 x 0.33) =	\$6,354	
		a IF 3D1 => 3C	THEN GO TO 4	,		, ,		
		b IF 3D1 < 3C TI	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =	\$5	
		c IF 3D1b => 1 T			,	,		
		d IF 3D1b < 1 Th	HEN PROJECT	DOES NOT QUALIFY				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$1,510
5	то	TAL NET DISCOUN	ITED SAVINGS	3		(2F5 + 3C) =		\$26,411
6	DIS	SCOUNTED SAVING	SS-TO-INVES	TMENT RATIO (SIR)		(5/1F) =		5.56
	(11	F SIR < 1 THEN PRO	DJECT DOES I	NOT QUALIFY)				
7	SIM	MPLE PAYBACK (SF	PB)			(1F/4) =		3.14

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NWC							
CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SOL	JTH WADSW	ORTH BLV)., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	D 80227	
CONTRACT	CONTRACT FOR (Work to be performed) ECO'S FOR MODIFIED CONFIGURATION – BLDG. 21695	BLDG. 216	995				PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	9ER		WORK LOCATION WHITE SAN	DS MISSILE	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	LCOST		LABOR COSTS			
Line	Item	5 5	Quantity			Manhours	Average		Other Direct	Line
o N	Ξ	Measure (2)	ව	<u>5</u>	Total (5)	Mandays (6)	Rate	Total (8)	Costs	Total (10)
1	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	EA	166	2.19	363.54	0.09	27.60	403.18		\$766.72
	ENERGY EFFICIENT BALLASTS	EA	93	14.06	1307.58	0.85	27.60	2184.35		\$3,491.93
	TOTAL									\$4,258.65
7	SETBACK / SETUP THERMOSTAT (TOTAL)	EA	-	108.63	108.63	1.00	27.63	27.63		\$136.26
	TOTAL FOR MODIFIED CONFIGURATION									\$4,394.91
				·						
	·									
	Source: Lightbutb Supply Co., Denver, CO; Means Electrical & Mechanical Cost Data, 1992, Material prices include 25 % overhead & profit, Labor Source: U.S. Dept. of Labor, General Wage Decision No. NM91-1	Coet Date, 1992;	Material prices in	nclude 25 % over	head & profit, Labor S	Source: U.S. Dept. o	f Labor, General Wa	ge Decision No. NM9	11-1	

ESOS STUDY AT WSMR - BUILDING 21695
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.

ALT 1 - MODIFIED BILL ALTS 2,3,4 - SYNG (MODIFIED BASELINE)

Weather File Code:	ELPASO	o.w
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(12.0)
Density-Specific Heat Doods	0.0575	(Dear Colly 1)

Air Specific Heat:

Density-Specific Heat Prod:
Latent Heat Factor:

Enthalpy Factor:

0.2444 (Btu/lbm/F)

0.9575 (Btu-min./hr/cuft/F)

4,214.8 (Btu-min./hr/cuft)

3.9171 (Lb-min./hr/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 16:51:55 6/18/92 Dataset Name: 21695M .TM

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	14,543	67	1,643	14
Feb	13,098	67	1,267	13
March	14,900	67	351	11
April	13,765	65	0	0
May	18,655	89	0	0
June	23,338	100	0	0
July	25,943	105	0	0
Aug	25,664	102	0	0
Sept	18,034	89	0	0
Oct	14,500	65	0	0
Nov	13,804	67	470	11
Dec	14,198	67	1,116	13
Total	210,442	105	4,847	14

Building Energy Consumption = Source Energy Consumption = 69,194 (Btu/Sq Ft/Year) 70,056 (Btu/Sq Ft/Year) Floor Area =

17,385 (Sq Ft)

2 KW 950

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Trane Air Conditioning Economics

By: Trane Customer Direct Service Network
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ESOS STUDY AT WSMR - BUILDING 21695
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
ALT 1 - MODIFIED BSLN, ALTS(2)3,4 - SYNG (SETBACK-SETUP T-STAT)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 3,918 (ft) Elevation: Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F)

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr.

Summer Ground Relectance:

Winter Ground Relectance:

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

0.20

0.20

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 17:29: 0 6/18/92

Dataset Name: 21695M .TM

----- MONTHLY ENERGY CONSUMPTION -----

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	15,499	67	2,930	8
Feb	13,955	67	2,252	7
March	15,131	67	579	4
April	14,375	65	0	0
May	22,840	88	0	0
June	29,740	100	0	0
July	34,187	104	0	0
Aug	32,899	101	0	0
Sept	22,750	89	0	0
Oct	15,560	65	0	0
Nov	14,158	67	818	4
Dec	15,207	67	2,165	6
Total	246,303	104	8,743	8

Building Energy Consumption = Source Energy Consumption =

San an Assessabilit

98,643 (Btu/Sq Ft/Year) 100,198 (Btu/Sq Ft/Year)

2KW = 947

Floor Area = 17,385 (Sq Ft)

ESOS STUDY AT WSMR - BUILDING 21695
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
ALT 1 - MODIFIED BSLN, ALTS 2(3),4 - SYNG (ENERGY EFFICIENT LIGHTING)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F)

Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

Air Density:

Air Specific Heat:

Density-Specific Heat Prod:
Latent Heat Factor:
Enthalpy Factor:

0.2444 (Btu/lbm/F)

0.9575 (Btu-min./hr/cuft/F)

4,214.8 (Btu-min./hr/cuft)

3.9171 (Lb-min./hr/cuft)

0.0653 (Lbm/cuft)

Design Simulation Period: May To October
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 18: 6: 4 6/18/92

Dataset Name: 21695M .TM

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3

------ MONTHLY ENERGY CONSUMPTION ------

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	15,865	69	2,898	8
Feb	14,286	69	2,224	7
March	15,510	69	568	4
April	14,201	67	0	0
May	19,148	91	0	0
June	23,852	103	0	0
July	26,429	107	0	0
Aug	26,205	104	0	0
Sept	18,494	91	0	0
Oct	14,979	67	0	0
Nov	14,508	69	797	4
Dec	15,501	69	2,130	6
Total	218,978	107	8,617	8

Building Energy Consumption = Source Energy Consumption =

entality and the exercision

92,556 (Btu/Sq Ft/Year) 94,089 (Btu/Sq Ft/Year)

EKW= 975

Floor Area = 17,385 (Sq Ft)

		LOCATION: Whi		_	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				RGY EFFICIENT LIGHTI	NG		FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/17/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1		VESTMENT						
		CONSTRUCTION	COST	=			\$11,338	
	_	SIOH COST		(5.5% of 1A) =			\$624	
	C.			(6.0% of 1A) =			\$680	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$12,642	
		SALVAGE VALUE		45 45			\$0	
	г.	TOTAL INVESTME	EIN 1	(1D – 1E) =			 >	\$12,842
2	FN	ERGY SAVINGS (+)	V COST (-)					
_	,	FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)		
	A.	ELEC	\$6.48	711	\$4,604	15,23	\$AVINGS (5) \$70,123	
	В.		40.40	0	\$4,004	17.28	\$70,123	
		PROPANE	\$ 8.71	(334)	•		(\$44,056)	
		PAPER	44	0	\$0	18.04	(\$44,050) \$0	
	Ε.	COAL		•	\$0	16.22	\$0	
	F.	TOTAL		377	2,361.1	10.22	>	\$26,068
				•	2,001.1			420,000
3	NO	N-ENERGY SAVIN	IGS (+) / COST ((-)				
				C. DEMAND SAVINGS)	=		\$4,154	
		1 DISCOUNT FAC	TOR	ŕ	(From Table A-2) =	14.68	4 ,,	
		2 DISCOUNTED S	SAVINGS (+) / C	OST (-)	(3A x 3A1) =		\$60,973	
	B.	NON-RECURRING	G (+/-)		, ,		,	
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c. .		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENE	RGY DISCOUN	TED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$60,973
	D.	PROJECT NON-E	NERGY TEST					
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$8,602	
		a IF 3D1 => 3C1	THEN GO TO 4					
		b IF 3D1 < 3C TI	HEN CALCULAT	TE SIR		(2F5 + 3D1) / 1F =	2.74	
		c IF 3D1b => 1 T				-		
		d IF 3D1b < 1 Th	HEN PROJECT	DOES NOT QUALIFY				
A	FID	RST YEAR DOLLAR	SAVINGS	COSTS (_)	,	. 04 . (084 1/25)		
		TAL NET DISCOUN		JUSTS (-)	(2F3	+ 3A + (3B1d/25)) =	,	\$6,515
				MENT RATIO (SIR)		(2F5 + 3C) =		\$87,041
•		SIR < 1 THEN PRO				(5/1F) =		6.88
7		APLE PAYBACK (SP		O I WUALIFT)		(4 E (4)		
•	JIIV	== A DAUR (SF	U ,			(1F/4) =		1.94

							•	
		LOCATION: Whit	e Sands Missil	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	BLDG. 24072	- SETBACK/SETUP THI	ERMOSTAT – MODIFY	CONTROLS	FISCAL YEAR:	1992
		DISCRETE PORTK	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/30/92		ECONOMIC LIFE:	15	PREPARED BY:	A. NIEMEYER
1	IN۱	/ESTMENT						
	A.	CONSTRUCTION	COST	=			\$2,016	
	В.	SIOH COST		(5.5% of 1A) =			\$111	
	C.	DESIGN COST		(6.0% of 1A) =			\$121	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$2,248	
	E.	SALVAGE VALUE					\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$2,248
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	190	\$1,230	10.79	\$13,269	
	В.	DIST		0	\$0	11.57	\$0	
	C.	PROPANE	\$6.71	169	\$1,138	12.38	\$14,064	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	11.35	\$0	
	F.	TOTAL		359	2,365.7		>	\$27,332
3	NO	N-ENERGY SAVING	39 (4) / COST ((-)				
Ī				CT. DEMAND SAVINGS)	_		\$936	
		1 DISCOUNT FACT		or. Demand Caringo,	(From Table A-2) =	10.67	4930	
		2 DISCOUNTED S		OST (-)	(3A x 3A1) =	10.07	\$9,987	
	В.	NON-RECURRING		()	(5,1,1,0,1,1,) =		45,007	
		ITEM	` '		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
	C.	TOTAL NON-ENER	RGY DISCOUN	TED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$9,987
	D.	PROJECT NON-EN	IERGY TEST					
		1 25% MAXIMUM I	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$9,020	
		a IF 3D1 => 3C T	HEN GO TO 4					
	·	b IF 3D1 < 3C TH	EN CALCULA	TE SIR		(2F5 + 3D1) / 1F =	16.17	
		c IF 3D1b => 1 Ti	HEN GO TO 4					
		d IF 3D1b < 1 TH	EN PROJECT	DOES NOT QUALIFY				
4	FIR	ST YEAR DOLLAR S	SAVINGS (+) / (COSTS (-)	(2F3	+ 3A + (3B1d/15)) =		\$3,302
5	тот	TAL NET DISCOUNT	TED SAVINGS	-	•	(2F5 + 3C) =		\$37,319
6	DIS	COUNTED SAVING	S-TO-INVEST	MENT RATIO (SIR)		(5/1F) =		16.60
		SIR < 1 THEN PRO				• •		
7	SIM	PLE PAYBACK (SPE	3)			(1F/4) =		0.68

		LOCATION: White			REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				- DRY-BULB ECONOM	IZER ON AHU		FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/10/92		ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER
		/FOTMENT						
1		VESTMENT						
		CONSTRUCTION	COSI	=			\$2,047	
		SIOH COST		(5.5% of 1A) =			\$113	
		DESIGN COST		(6.0% of 1A) =			\$123	
		ENERGY CREDIT SALVAGE VALUE		(1A + 1B + 1C) =			\$2,282	
		TOTAL INVESTME	:NT	(4D 4D			\$0	
	г.	TOTAL INVESTME	:141	(1D – 1E) =			 >	\$2,282
2	EN	ERGY SAVINGS (+)	/COST(-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	10	\$66	10.79	\$714	
	В.	DIST		0	\$0	11.57	\$0	
	C.	PROPANE	\$6.71	0	\$0	12.38	\$0	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	11.35	\$0	
	F.	TOTAL		10	66.2		 >	\$714
							_	****
3	NO	N-ENERGY SAVIN	GS (+) / COST ((-)				
	A.	ANNUAL RECURR	ING (+/-) (ELE	C. DEMAND SAVINGS)	*		\$39	
		1 DISCOUNT FAC	TOR		(From Table A−2) =	10.67		
		2 DISCOUNTED S	AVINGS (+) / C	OST (-)	(3A x 3A1) =		\$416	
	В.	NON-RECURRING	à (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		C.		\$0		0.00	\$0	
	_	d TOTAL		\$0			\$0	
				TED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$416
	D.	PROJECT NON-EI						
		1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$236	
		a IF 3D1 => 3C T b IF 3D1 < 3C TH		TE OID				
		c IF 3D1b => 1 T		I E SIM		(2F5 + 3D1) / 1F =	0.42	
				DOES NOT QUALIFY				
		3 11 JOIN 1 1 11		DOLO NOT QUALIFY				
4	FIR	ST YEAR DOLLAR	SAVINGS (+) / (COSTS (-)	(2F3 ·	+ 3A + (3B1d/15)) =		\$105
		TAL NET DISCOUN			•	(2F5 + 3C) =		\$1,131
6	DIS	COUNTED SAVING	S-TO-INVEST	MENT RATIO (SIR)		(5/1F) =		0.50
		SIR < 1 THEN PRO				, , ,		7.55
7	SIM	IPLE PAYBACK (SP	B)			(1F/4) =		21.69

))	
	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKD	NMC							
CONTRACTOR	эн EMC ENGINEERS INC.			ADDRESS 2750 SOI	JTH WADSW	ORTH BLVI	J., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227) 80227	
CONTRACT	CONTRACT FOR (Work to be performed) ECO'S – BLDG. 24072						PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
				MATERIAL COST	L cost		LABOR COSTS			
Line	Item	of Chit	Quantity			Manhours	Average		Other Direct	Line
Ö	(1)	Measure (2)	ල	Unit	Total (5)	Mandays (6)	Rate	Total	Costs (9)	Total (10)
-	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
	4 FT. ENERGY EFFICIENT LAMPS	Æ	234	2.19	512.46	0.09	27.60	568.34		\$1,080.80
	ENERGY EFFICIENT BALLASTS	EA	117	14.06	1645.02	0.85	27.60	2748.05		\$4,393.07
	LIGHTING BRANCH CIRCUITS	5	1988	1.06	2104.74	0.07	27.60	3588.97		\$5,693.71
	LIGHTING SWITCHES	EA	12	90.9	72.72	0:30	27.60	98.04		\$170.76
7.5	LIGHTING PANEL BOARD	Ā	-	317.2	317.20	7.00	27.60	193.20		\$510.40
	TOTAL									\$11,338.33
2	MODIFY CONTROLS - INSTALL SETBACK/SETUP THERMOSTAT									
	SETBACK/SETUP THERMOSTAT	EA		108.6	108.6	1.00	27.63	27.63		\$136.26
	2" CONTROL VALVE - STEAM	ËA	1	494.0	494.0	2.00	35.81	71.62		\$565.62
	3" CONTROL VALVE - CHILLED WATER	EA	1	1056.0	1056.0	4.00	35.81	143.24	,	\$1,199.24
	PRESSURE/ELECTRIC SWITCH	EA	-	87.5	87.5	1.00	27.63	27.63		\$115.13
	TOTAL									\$2,016.25
	Source: Lightbulb Supply Co. Denver, CO: Means Electrical & Machanical Cost Data 1992 Material micros inclinds 55th months of a brottle labor accuracy. His Dant of labor Renazal Wass Pariston No. Nutot at Onschool & Brottle Inclindady	Cost Data 1992	Material prices in	trade 2504 parent	and & sendle 4 shoe an	11.8 Dent of	May Ganaral Way	Parteton No MM01	1 (Curberd & Dec	the hidedh

Source: Lightbulb Supply Co., Denver, CO; Means Electrical & Mechanical Cost Data, 1992; Material prices include 26% overhead & profit, Labor source: U.S. Dept. of Labor, General Wage Decision No. NM91-1 (Overhead & Profit Included); Richardson Cost Estimating Guide, 1992

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NW							
CONTRACTOR	R TAYO TAYONITIDO INO			ADDRESS	WOON THE	אום חדם כי	000 J#	ADDRESS ADDRES	70000	
CONTRACT	CONTRACT FOR (Work to be performed)			27.20			PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE	0 00551	
	ECO'S - BLDG. 24072									:
PURCHASER	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WHITE SANDS MISSILE	RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	.cosT		LABOR COSTS			
	mati	Coit	Quantity			Manhoure	Average		Other	ğ
No.	(General Control of Co	Measure	Godininy (S)	Unit	Total	Mandays	Rate	Total	Costs	Total
က	INSTALL DRY-BULB ECONOMIZER ON AHU	(2)	6	E	Ĉ.	E	S			
	MIXED AIR SENSOR	EA	1	148	147.5	0.67	35.81	23.99		\$171.49
:	RECEIVER CONTROLLER	EA	1	235	235	2.00	35.81	71.62		\$306.62
-	LOW-LEAKAGE DAMPERS	EA	2	217	434	6.00	27.63	331.56		\$765.56
D17	PNEUMATIC ACCUTATORS	EA	2	226	452	1.00	27.63	55.26		\$507.26
	PNEUMATIC TUBING	Ħ	90	0.80	72	0.00	27.63	223.80		\$295.80
	TOTAL									\$2,046.74
	Source: Lightbuib Supply Co., Denver, CO; Means Electrical & Mechanical Cost Data, 1982; Material prices include 25% overhead & profit, Labor source: U.S. Dept. of Labor, General Wage Decision No. NM91-1 (Overhead & Profit included); chardson Cost Estimating Guide, 1982	Il Cost Data, 1992;	Material prices in	clude 25% overh	ead & profit, Labor sc	ource: U.S. Dept. of	Labor, General Wa	ge Decision No. NM9	1-1 (Overhead & Profi	t included);

D17-6

**************************** TRACE 600 ANALYSIS

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ESOS STUDY AT WSMR - BUILDING 24072 WHITE SANDS MISSILE RANGE NM US ARMY

Sections

EMC ENGINEERS, INC. BLDG AUDIT: ALT 1-BSLN, ALTS 2,3,4 -ECOS (BASELINE)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) 6 Time Zone: Elevation: 3,918 (ft) Barometric Pressure: 25.8 (in. Hg) 1.00 Summer Clearness Number: 1.00

Winter Clearness Number: Summer Design Dry Bulb: 98 (F) 64 (F) Summer Design Wet Bulb: 24 (F) Winter Design Dry Bulb: Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft) Air Specific Heat: 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft) 3.9171 (Lb-min./hr/cuft) Enthalpy Factor:

Design Simulation Period: January To December System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 14:44:18 6/15/92

Dataset Name: 24072 .TM System 1 Peak SZ - SINGLE ZONE

Peaked at	Time ==:	•	Mo/Hr:	7/16			*	Mo/I	Hr: 7	'/16 ¹	,	Mo/Hr: 1	3/ 1	
Outside Ai	r ==>	OAI	B/WB/HR:	97/ 64/ 49.)		*	OAL	DB: 9	7	•	OADB:	24	
		Space	Ret Air	Ret. Air	Net	Percnt	*	Spa	ace	Percnt 1	' Space Pe	ak Coil	Peak	Percnt
	Sé	ens.+Lat.	Sensible		Total			Sensil		Of Tot	Space Se			Of Tot
Envelope L		(Btuh)	(Btuh)		(Btuh)			(Bti		(%)	•		tuh)	(%)
Skylite		0	(51)		(1.1			, , ,	0	0.00	· ·	0	0	0.00
Skylite		0	Č		0				0	0.00		0	0	0.00
Roof Con		47,136	ò		47,136			56,9	918	17.04		35 -60	,935	9.52
Glass Sc		0	Č		,				0	0.00	-	0	. 0	0.00
Glass Co		0	Č		0				0	0.00		0	0	0.00
Wall Con		67,040	ò		67,040			76,	571	22.93		35 -151	,335	23.65
Partitio		13,840	-		13,840			13,8		4.14			-	17.30
Exposed		0			,				0	0.00	-	0	0	0.00
Infiltra		29,500			29,500			102,2	293	30.63		56 -211	,356	33.03
Sub Tota		157,516	d	1	157,516			249,6		74.75			•	83.51
Internal L		157,510	`	•	137,310	47.01	*	E-17,1			,		,	
Lights	oaus	46,854	C	1	46,854	14.82	*	46,8	R54	14.03	•	0	0	0.00
People		4,020	•	•	4,020			2,3		0.72		0	0	0.00
Misc		31,741	C	0	31,741			31,7		9.51		•	,000	-1.88
Sub Tota	1	82,614		-	82,614			80,9		24.25			,000	-1.88
Ceiling Lo		02,014			02,014			00,	0	0.00	•	0	0	0.00
Outside Ai		0			33,118				0	0.00			,543	18.37
Sup. Fan H		·	`	,	39,680				•	0.00		•	0	0.00
Ret. Fan H			C	1	37,000					0.00			0	0.00
Duct Heat			Ċ		Č					0.00	,		0	0.00
OV/UNDR Si		3,320	`	•	3,320			3 7	320	0.99	,	0	ō	-0_00
Exhaust He	-	5,525	C	0				٠,٠		0.00	•	•	ō	
Terminal B			Č		o					0.00	•		0	0.00
	•	2/7 /52			74/ 0/8	400.00	*	777 /	20	100.00 1		/E	909	400.00
Grand Tota	(z=>	243,450	C	0	310,248	100.00	•	333,9	930	100.00 *	-522,3	45 -639	,000	100.00
				LING COIL SE					· · · · · · ·			AREAS-		
		apacity	Sens Cap.			ng DB/WB,			-	/WB/HR	Gross Tot		SS (SI	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	-		Deg F [-			33,125		
Main Clg	26.4	316.2	421.2	27,900			3.6		56.1	70.5		23,574		
lux Clg	0.0	0.0	0.0	. 0			0.0	0.0	0.0	0.0	Exflr	0		
Opt Vent Totals	0.0 26.4	0.0 316.2	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof Wall	12,463 6,408		0 0
			•						_					
	-HEATING Capacity		CTION irfl Ent	Lvg	Type	RFLOWS (d		eating		NGINEERING % OA	CHECKS	TEMPER	ATURES Clg	(F) Htg
	(Mbh)	(cfn		-	Vent	2,790		2,790	_	Cfm/Sqft	0.84	SADB	62.5	
Main Htg	-639.9		. •	•	Infil	5,017		5,017	_	Cfm/Ton	1058.66	Plenum	75.0	
lux Htg	0.0	-	0.0		Supply	27,900		27,900	-	Sqft/Ton	1256.92	Return	75.0	
Preheat	-0.0				Mincfm	21,700		0	-	Btuh/Sqft		Ret/OA	77.3	
Reheat	0.0		0.0		Return	27,900		27,900		People	9	Runarnd	75.0	
lumidif	0.0		0 0.0		Exhaust	2,790		2,790		% OA	10.0	Fn MtrTD	0.4	
opt Vent	0.0		0 0.0		Rm Exh	0		0	-	Cfm/SqFt	0.84	Fn BldTD		
- p = 1 = 11 = 1	~	•	- 0.0	J.0		v		•			****	0		

.co48<u>538</u>860

System 2 Peak INCHP - INCREMENTAL HEAT PUMP

Peaked at Time ==		Mo/Hr:	-			#	Mo/		'/16 *		Mo/Hr: 13		
Outside Air ==>	OA	DB/WB/HR:	97/ 64/ 49.0)		*	OA	DB: 9	7 *		OADB: 2	24	
	Space	Ret Air	Ret. Air	Net	Percnt	*	Sp	ace	Percnt *	Space Pea	ak CoilF	Peak	Percn
s	ens.+Lat.	Sensible	Latent	Total	Of Tot	*	Sensi		Of Tot *	Space Ser			Of To
Envelope Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*		uh)	(%) *	(Btul	h) (Bi	tuh)	(%
Skylite Solr	0	0		0	0.00	*	•	0	0.00 *		0	0	0.0
Skylite Cond	0	0		0	0.00	*		0	0.00 *		0	0	0.0
Roof Cond	6,182	0	•	6,182	14.51	*	6,	182	15.39 *	-8,5	54 -8,	,554	52.7
Glass Solar	· o	0		0	0.00	*		0	0.00 *		0	0	0.0
Glass Cond	0	0		0	0.00	*		0	0.00 *		0	0	0.0
Wall Cond	0	0		0	0.00	*		0	0.00 *		0	0	0.0
Partition	476			476	1.12	*		476	1.19 *	-3,8	I1 -3 ,	,811	23.5
Exposed Floor	0			0	0.00	*		0	0.00 *		0	0	0.0
Infiltration	2,641			2,641	6.20	*	1,	946	4.84 *	-3,83	39 -3 ,	,839	23.6
Sub Total==>	9,299	0		9,299	21.83	*	8,	604	21.41 *	-16,20	04 -16,	,204	100.0
Internal Loads						*			*				
Lights	26,048	0		26,048	61.14	*	26,	048	64.83 *		0	0	0.0
People	2,680			2,680	6.29	*	1,	380	3.43 *		0	0	0.0
Misc	4,147	0	0	4,147	9.73	*	4,	147	10.32 *		0	0	0.0
Sub Total==>	32,875	0	0	32,875	77.17	*	31,	575	78.59 *		0	0	0.0
Ceiling Load	0	0		0	0.00	*		0	0.00 *		0	0	0.0
Outside Air	0	0	0	0	0.00	*		0	0.00 *		0	0	0.0
Sup. Fan Heat				427	1.00	*			0.00 *			0	0.0
Ret. Fan Heat		0		0	0.00	*			0.00 *			0	0.0
Duct Heat Pkup		0		0	0.00	*			0.00 *			0	0.0
OV/UNDR Sizing	0			0	0.00	*		0	0.00 *		0	0	0.0
Exhaust Heat		0	0	0	0.00	*			0.00 *			0	0.
Terminal Bypass		0	0	0	0.00	*			0.00 *			0	0.1
Grand Total==>	42,174	0	0	42,601	100.00	*	40,	179	100.00 *		04 -16,	,204	100.
	*****	C00	LING COIL SI	ELECTION		••••					AREAS-		
Total	Capacity	Sens Cap.	Coil Airfl	Enteri	ng DB/WB/	/HR	Leav	ring DE	J/WB/HR	Gross Tota	al Glas	ss (sf	f) (%)
(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	g F Gra	ins	Deg F	Deg F	Grains	Floor	2,430		
ain Clg 3.6	42.6	40.6	1,200	75.2 5	3.4 30	6.2	39.8	36.9	32.9	Part	711		
ux Clg 0.0	0.0	0.0	0			0.0	0.0	0.0	0.0	ExFlr	0		
pt Vent 0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	2,430		0
otals 3.6	42.6									Wall	0		0
		ECTION		AII					NGINEERING		TEMPERA		
Capacit	•		Lvg	Type	Cooling		leating	•	% OA	0.0	Type	Clg	
(Mbh)		-	-	Vent	0		0	7	Cfm/Sqft	0.49	SADB	40.0	
ain Htg -25.	•	200 59.6		Infil	91		91	_	Cfm/Ton	338.02	Plenum	75.0	
ux Htg 0.		0.0		Supply	1,200		1,200		Sqft/Ton	684.50	Return	75.0	
reheat -0.		200 68.0		Mincfm	1 200		4 200		Btuh/Sqft		Ret/OA	75.0	
eheat 0.		0 0.0		Return	1,200		1,200		People	4	Runarnd	75.0	
	u	0 0.0	0.0	Exhaust	0		. 0	HTG	7 % OA	0.0	Fn MtrTD	0.1	10.
umidif 0. pt Vent 0.		0 0.0		Rm Exh	0		0		Cfm/SqFt	0.49	Fn BldTD		1 0.

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 24072

------ BUILDING U-VALUES------

				*****	Roc	m U-Val	ues	·			Room	Room
					(Btu	/hr/sqf	t/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	Exflr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	2ND FLR- GRD LVL	0.000	0.000	0.000	0.000	0.130	0.000	0.000	0.610	0.000	169.8	34.74
Zone	1 Total/Ave.	0.000	0.000	0.000	0.000	0.130	0.000	0.000	0.610	0.000	169.8	34.74
2	1ST FLR MEZZ LVL	0.470	0.000	0.000	0.000	0.080	0.000	0.000	0.422	0.000	104.5	21.21
Zone	2 Total/Ave.	0.470	0.000	0.000	0.000	0.080	0.000	0.000	0.422	0.000	104.5	21.21
3	BASEMENT	0.602	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	161.1	32.23
Zone	3 Total/Ave.	0.602	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	161.1	32.23
System	1 Total/Ave.	0.587	0.000	0.000	0.000	0.111	0.000	0.000	0.537	0.000	143.4	28.97
4	1ST FLR OFC AREA	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
Zone	4 Total/Ave.	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
System	2 Total/Ave.	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
Buildin	g	0.590	0.000	0.000	0.000	0.106	0.000	0.000	0.537	0.000	141.9	28.72

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 24072

3334443564455G

Room		Dupl		Floor Area/Dupl Room	Total Floor Area	Partition Area	Exposed Floor Area	Skylight Area	/Rf	Net Roof Area	Window Area	/wt	Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	2ND FLR- GRD LVL	1	1	7,757	7,757	0	0	0	0	7,757	0	0	3,906
Zone	1 Total/Ave.				7,757	0	0	0	0	7,757	0	0	3,906
2	1ST FLR MEZZ LVL	1	1	11,568	11,568	2,706	0	0	0	4,706	0	0	2,502
Zone	2 Total/Ave.				11,568	2,706	0	0	0	4,706	0	0	2,502
3	BASEMENT	1	1	13,800	13,800	20,868	0	0	0	0	0	0	0
Zone	3 Total/Ave.				13,800	20,868	0	0	0	0	0	0	0
System	1 Total/Ave.				33,125	23,574	0	0	0	12,463	0	0	6,408
4	1ST FLR OFC AREA	1	1	2,430	2,430	711	0	0	0	2,430	0	0	0
Zone	4 Total/Ave.				2,430	711	0	0	0	2,430	0	0	0
System	2 Total/Ave.		•		2,430	711	0	0	0	2,430	0	0	0
Buildin	g				35,555	24,285	0	0	0	14,893	0	0	6,408

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

System Totals

មន្ត្រីមួយ មានក្រុមប្រជាជា

Percent	Cool	ing Loa	d	Heati	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
	4.5	74	2.754	77 20/	•	720	4 /55 0	0	O		a	•
0 - 5	1.5	31	2,751	-33,284	9	320	1,455.0	-	U	0.0	•	U
5 - 10	3.0	27	2,337	-66,569	11	399	2,910.0	0	U	0.0	0	0
10 - 15	4.5	0	0	-99,853	9	327	4,365.0	0	0	0.0	0	0
15 - 20	6.0	5	414	-133,138	10	378	5,820.0	0	0	0.0	0	0
20 - 25	7.5	3	232	-166,422	11	390	7,275.0	0	0	0.0	0	0
25 - 30	9.0	1	53	-199,707	12	434	8,730.0	0	0	0.0	0	0
30 - 35	10.5	1	90	-232,991	18	637	10,185.0	0	0	0.0	0	0
35 - 40	12.0	1	97	-266,275	9	340	11,640.0	0	0	0.0	0	0
40 - 45	13.5	3	244	-299,560	6	235	13,095.0	0	0	0.0	0	0
45 - 50	15.0	2	140	-332,844	5	164	14,550.0	0	0	0.0	0	0
50 - 55	16.4	4	311	-366,129	0	0	16,005.0	0	0	0.0	0	0
55 - 60	17.9	6	499	-399,413	0	0	17,460.0	0	0	0.0	0	0
60 - 65	19.4	5	447	-432,698	0	0	18,915.0	0	0	0.0	0	0
65 - 70	20.9	8	722	-465,982	0	0	20,370.0	0	0	0.0	0	0
70 - 75	22.4	4	363	-499,266	0	0	21,825.0	0	0	0.0	0	0
75 - 80	23.9	1	60	-532,551	0	0	23,280.0	0	0	0.0	0	0
80 - 85	25.4	0	0	-565,835	0	0	24,735.0	0	0	0.0	0	0
85 - 90	26.9	0	0	-599,120	0	0	26,190.0	0	0	0.0	0	0
90 - 95	28.4	0	0	-632,404	0	0	27,645.0	0	0	0.0	0	0
95 - 100	29.9	0	0	-665,688	0	0	29,100.0	100	8,760	0.0	0	0
Hours Off	0.0	0	0	0	0	5,136	0.0	0	0	0.0	0	8,760

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	34,927	53	2,610	6
Feb	31,774	53	1,832	6
March	35,974	53	244	3
April	29,012	46	0	0
May	40,561	69	0	0
June	45,363	79	0	0
July	50,110	82	0	0
Aug	46,849	79	0	0
Sept	37,944	67	0	.0
Oct	30,208	56	0	0
Nov	34,172	53	317	3
Dec	35,798	53	1,585	4
Total	452,691	82	6,590	6

Building Energy Consumption = 61,988 (Btu/Sq Ft/Year)
Source Energy Consumption = 62,562 (Btu/Sq Ft/Year)

Floor Area =

35,555 (Sq Ft)

EKW = 743 Baseline

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

-----UTILITY PEAK CHECKSUMS-----

Utility ELECTRIC DEMAND

Peak Value 82.5 (kW)
Yearly Time of Peak 15 (hr) 7 (mo)

Hour 15 Month 7

Eqp. Ref. Num.	Equipment Code Name		Jtility Demand (kW)	Percnt Of Tot (%)
Cooling (Equipment	•		
1	EQ1121L	AIR-CLD RECIP 35-60 TONS	34.6	41.93
2	EQ1288S	AIR TO AIR HEAT PUMP <11 TONS	4.6	5.59
Sub Tota	ι		39.2	47.52
Sub Tota	ι		0.0	0.00
Air Movi	ng Equipment			
1		SUMMATION OF FAN ELECTRICAL DEMAND	14.9	18.09
Sub Tota	t		14.9	18.09
Sub Tota	ι		0.0	0.00
Miscella	neous			
Lights			21.4	25.90
Base Ut	ilities		0.0	0.00
Misc Eq	uipment		7.0	8.49
Sub Tota	l		28.4	34.39
Grand To	tal		82.5	100.00

************************ ************************************ TRACE 600 ANALYSIS

ESOS STUDY AT WSMR - BUILDING 24072 WHITE SANDS MISSILE RANGE NM US ARMY BLDG AUDIT: ALT 1-BSLN, ALTS 23,4 -ECOS (ENERGY EFFICIENT LIGHTING)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 3,918 (ft) Elevation: Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20 Air Density: 0.0653 (Lbm/cuft)

444498999

Air Specific Heat: 0.2444 (Btu/lbm/F) Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) 4,214.8 (Btu-min./hr/cuft) Latent Heat Factor: Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: January To December System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

15:18: 9 6/15/92 Time/Date Program was Run: 24072 .TM

Dataset Name:

0.0

-639.9

Total

Opt Vent

0.0

0.0

Rm Exh

Auxil

SZ - SINGLE ZONE System 1 Peak

	t Time ==	******* C O	Mo/Hr: 7				*	Mo/Hi		/16 *			Hr: 13/ 1	•	
Outside /			B/WB/HR: 9	97/ 64/ 49.0	0		*	OADE	3: 9	7 *		OAI	DB: 24		
							*			*					
		Space	Ret. Air	Ret. Air	Net	Percnt		Space		Percnt *	Space P		Coil Peak	Per	
	S	ens.+Lat.	Sensible	Latent	Total			Sensib		Of Tot *	Space S		Tot Sens	Of	
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)			(Btui		(%) *	(Bt		(Btuh)		(%
Skylite	e Solr	0	0		(0	0.00 *		0	0		0.0
Skylite	e Cond	0	0		(0	0.00 *		0	0		0.0
Roof Co	ond	47,136	0		47,136			56,9		17.04 *	-60,	_	-60,935		9.5
Glass :	Solar	0	0		(0	0.00 *		0	0		0.0
Glass	Cond	0	0					-, -	0	0.00 *	454	0	0		0.0
Wall Co		67,040	0		67,040			76,57		22.93 *	-		-151,335		3.6
Partit	ion	13,840			13,840			13,84		4.14 *	=		-110,718		7.3
Expose	d Floor	0			(0	0.00 *		0	0		0.0
Infilt	ration	29,522			29,522			102,29		30.63 *			-211,356		3.0
Sub To	tal==>	157,538	0		157,538	50.63		249,67	21	74.75 *	-534,	345	-534,345	83	3.5
Internal	Loads	•					*	-= -		*			•	_	
Lights		8,645	0		8,645			13,74		4.12 *		0	0		0.0
People		4,020			4,020			2,39		0.72 *		0	0		0.0
Misc		31,741	0	0	31,741			31,74		9.51 *		000	12,000		1.8
Sub To	tal==>	44,406	0	0	44,406			47,8		14.34 *	12,		12,000		1.8
Ceiling	Load	0	0		(0	0.00 *		0	0		0.0
Outside /	Air	0	0	0	33,124				0	0.00 *		0	-117,543		8.3
Sup. Fan	Heat				39,680					0.00 *			. 0		0.0
Ret. Fan	Heat		0		(0.00 *			0		0.0
Duct Heat	•		0							0.00 *			0		0.0
OV/UNDR S	Sizing	36,425		_	36,425			36,47	25	10.91 *		0	0	-2	
Exhaust i			0	. 0	(0.00 *			0		
Terminal	Bypass		0	0	(0.00	*			0.00 *			0	,	0.0
Grand To	tal==>	238,369	0	0	311,173	100.00	*	333,93	30	100.00 *	-522,	345	-639,888	100	0.0
			COOL	LING COIL SI	ELECTION							A	REAS		
	Total			Coil Airfl		ing DB/WB,				/WB/HR	Gross To	tal	Glass (s	f) ((%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	g F Gra	ins	Deg F De	eg F	Grains	Floor	33,12	5		
ain Clg	25.9	311.2	416.1	27,900	77.3	50.2 63	3.6	61.0	56.2	70.8	Part	23,57	4		
ux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	1	0		
pt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	12,46	3	0	
otals	25.9	311.2									Wall	6,40	8	0	1
	HEATIN	G COIL SELE	CTION		A1	RFLOWS (cfm)		E	NGINEERING	CHECKS	TI	EMPERATURE	S (F))
	Capacit	y Coil Ai	rfl Ent	Lvg	Type	Cooling		Heating	Clg	% OA	10.0	T	ype Clg	, ,	Htg
	(Mbh)	(cfm) Deg F	Deg F	Vent	2,790		2,790	Clg	Cfm/Sqft	0.84	SAD	B 62.	5 8	B7.
ain Htg	-639.	9 27,9	00 63.6	87.6	Infil	5,017		5,017	Clg	Cfm/Ton	1075.93	Ple	num 75.	0 6	68.
ux Htg	0.		0.0	0.0	Supply	27,900		27,900	Clg	Sqft/Ton	1277.43	Ret	urn 75.	0 6	68.
reheat	-0.		00 63.6	61.0	Mincfm	0		0	Clg	Btuh/Sqft	9.39	Ret.	/OA 77.	3 6	63.
eheat	0.	-	0.0	.0.0	Return	27,900		27,900	No.	People	9	Run	arnd 75.	0 6	68.
umidif	0.		0.0	0.0	Exhaust	2,790		2,790	Htg	% OA	10.0	Fn I	MtrTD 0.	4	0.
		^			De Fub				Uta	Cém/CaE+	0.84	En	n atkie	7	0

0

0

Htg Cfm/SqFt

Htg Btuh/SqFt

0

0

Fn BldTD

Fn Frict

0.84

-19.32

0.3

0.8

0.0

0.0

-ભાગમાં <u>કોઈ હોવા</u> છે.

Humidif

Opt Vent

Total

0.0

0.0

-25.8

0

0.0

0.0

0.0

0.0

Exhaust

Rm Exh

Auxil

System	2	Peak	INCHP	•	INCREMENTAL HEAT	PUMP

Peaked at	: Time ==>			7/16			*			7/16 *	****** HEAT	Mo/Hr: 1		
Outside A				97/ 64/ 49.1)		*		ADB:			OADB:		
outside A		O/W	, D, ND, 1111.	,,, 04, 4,			*	· ·		*				
		Space	Ret. Air	Ret. Air	Ne	t Percn	t *	Si	pace	Percnt *	Space Pea	k Coil	Peak	Percn
	Se	ns.+Lat.	Sensible	Latent	Tota			Sens		Of Tot *	Space Sen			Of To
Envelope		(Btuh)	(Btuh)	(Btuh)	(Btuh				tuh)	(%) *	(Btuh		tuh)	(%
Skylite		0	0			0.0		•	0	0.00 *		0	0	0.0
Skylite		0	0			0.0			0	0.00 *		0	0	0.0
Roof Co	ond	6,182	0		6,18	2 27.3	1 *	6	, 182	28.25 *	-8,55	4 -8	,554	52.7
Glass S	olar	. 0	0		_	0.0) *		0	0.00 *		0	0	0.0
Glass C	ond	0	0			0.0	*		0	0.00 *		0	0	0.0
Wall Co		0	0			0 0.0			0	0.00 *		0	0	0.0
Partiti		476			47				476	2.18 *	-3,81	1 -3	,811	23.5
Exposed		0				0 0.0			0	0.00 *	-	0	0	0.0
Infiltr		972			97		, *	1	.946	8.89 *	-3,83	-	,839	23.6
Sub Tot		7,630	0		7,63			·	604	39.31 *	-16,20		,204	100.0
Internal		. ,000	•		.,				,	*	,		,	
Lights	20000	7,754	0		7,75	4 34.2	5 *	7	,754	35.43 *		0	0	0.0
People		2,680	·		2,68				,380	6.31 *		0	0	0.0
Misc		4,147	0	0	4,14				,147	18.95 *		0	0	0.0
Sub Tot	-al ==>	14,581	0	0	14,58				,281	60.69 *		0	0	0.0
Ceiling L		0	0	•	•	0 0.0			0	0.00 *		0	0	0.0
Outside A		0	0	0		0 0.0			0	0.00 *		0	0	0.0
Sup. Fan		•	·	•	42				•	0.00 *		•	0	0.0
Ret. Fan			0			0 0.0				0.00 *			0	0.0
Duct Heat			0			0 0.0				0.00 *			Ō	0.0
OV/UNDR S		0	•	•		0 0.0			0	0.00 *		0	0	0.0
Exhaust H	_	•	0	0		0 0.0			-	0.00 *			0	0.0
Terminal			0	0		0 0.0				0.00 *			0	0.0
	-,,						*			*				
Grand Tot	;a(==>	22,212	0	0	22,63	8 100.0	0 *	21	,885	100.00 *	-16,20	4 -16	,204	100.0
		•••••••	cool	LING COIL SI	LECTION							AREAS-		•••••
	Total C	apacity	Sens Cap.	Coil Airfl	Enter	ing DB/W	B/HR	Lea	ving [OB/WB/HR	Gross Tota	il Gla	ss (sf) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	-	eg F Gr		Deg F	-	Grains	Floor	2,430		
lain Clg	1.9	22.6	22.3	1,200	75.2	60.2	66.7	55.7	53.2	2 66.2	Part	711		
lux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0		ExFlr	0		
pt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	2,430		0
otals	1.9	22.6									Wall	0		0
			CTION		A	IRFLOWS	(cfm)		-ENGINEERING	CHECKS	TEMPER	ATURES	(F)
	Capacity			Lvg	Type	Coolin	-	Heating		lg % OA	0.0	Type	Clg	Htg
	(Mbh)	(cfn	_	Deg F	Vent		0	0	-	lg Cfm/Sqft	0.49	SADB	56.0	
ain Htg	-25.8	•	200 59.6	82.1	Infil	9	1	91		lg Cfm/Ton	636.09	Plenum	75.0	
ux Htg	0.0		0.0	0.0	Supply	1,20		1,200		lg Sqft/Ton	1288.09	Return	75.0	
reheat	-0.0	•	200 68.0	55.6	Mincfm		0	0	CI	lg Btuh/Sqft	9.32	Ret/OA	75.0	
eheat	0.0		0.0	0.0	Return	1,20	0	1,200	No	o. People	4	Runarnd	75.0	68.

0

0

0

0

0

Htg % OA

Htg Cfm/SqFt

Htg Btuh/SqFt

0.0

0.49

-10.62

Fn MtrTD

Fn BldTD

Fn Frict 0.2

0.1

0.1

0.0

0.0

0.0

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

BUILDING U-VALUES - ALTERNATIVE 2
ENERGY EFFICIENT LIGHTING - BLDG 24072

------ BUILDING U-VALUES-----

					Roo	m U-Val	ues				Room	Room
				Mass	Capac.							
Room				Summr	Wintr		Summe	Wintr			(lb/	(Btu/
Number	Description	Part.	Exflr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	2ND FLR- GRD LVL	0.000	0.000	0.000	0.000	0.130	0.000	0.000	0.610	0.000	169.8	34.74
Zone	1 Total/Ave.	0.000	0.000	0.000	0.000	0.130	0.000	0.000	0.610	0.000	169.8	34.74
2	1ST FLR MEZZ LVL	0.470	0.000	0.000	0.000	0.080	0.000	0.000	0.422	0.000	104.5	21.21
Zone	2 Total/Ave.	0.470	0.000	0.000	0.000	0.080	0.000	0.000	0.422	0.000	104.5	21.21
3	BASEMENT	0.602	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	161.1	32.23
Zone	3 Total/Ave.	0.602	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	161.1	32.23
System	1 Total/Ave.	0.587	0.000	0.000	0.000	0.111	0.000	0.000	0.537	0.000	143.4	28.97
. 4	1ST FLR OFC AREA	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.5.	32
Zone	4 Total/Ave.	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
System	2 Total/Ave.	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
Buildin	g	0.590	0.000	0.000	0.000	0.106	0.000	0.000	0.537	0.000	141.9	28.72

BUILDING AREAS - ALTERNATIVE 2
ENERGY EFFICIENT LIGHTING - BLDG 24072

-----BUILDING AREAS -----

				Floor	Total		Exposed						
		Numb	er of	Area/Dupl	Floor	Partition	Floor	Skylight	Skl	Net Roof	Window	Win	Net Wall
Room			icate	Room	Area	Area	Area	Area	/Rf	Area	Area	/WL	Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	2ND FLR- GRD LVL	1	1	7,757	7,757	0	0	0	0	7,757	0	0	3,906
Zone	1 Total/Ave.				7,757	0	0	0	0	7 <i>,7</i> 57	0	0	3,906
2	1ST FLR MEZZ LVL	1	1	11,568	11,568	2,706	0	0	0	4,706	0	0	2,502
Zone	2 Total/Ave.				11,568	2,706	0	0	0	4,706	0	0	2,502
3	BASEMENT	1	1	13,800	13,800	20,868	0	0	0	0	0	0	0
Zone	3 Total/Ave.				13,800	20,868	0	0	0	0	0	0	0
System	1 Total/Ave.				33,125	23,574	0	0	0	12,463	0	0	6,408
4	1ST FLR OFC AREA	1	1	2,430	2,430	711	0	0	0	2,430	0	0	0
Zone	4 Total/Ave.				2,430	711	0	0	0	2,430	0	0	0
System	2 Total/Ave.				2,430	711	0	0	0	2,430	0	0	0
Buildin	g				35,555	24.285	0	0	0	14,893	0	0	6,408

------SYSTEM LOAD PROFILE -----

System Totals

Percent Cooling Load		Heati	ng Load		Cooling	Airflow		Heating Airflow					
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours	
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)		
0 - 5	1.4	1	51	-33,284	0	0	1,455.0	0	0	0.0	0	0	
5 - 10	2.8	0	10	-66,569	6	225	2,910.0	0	0	0.0	0	0	
10 - 15	4.2	17	651	-99,853	9	327	4,365.0	0	0	0.0	0	0	
15 - 20	5.6	3	101	-133,138	10	377	5,820.0	0	0	0.0	0	0	
20 - 25	7.0	6	237	-166,422	11	394	7,275.0	0	0	0.0	0	0	
25 - 30	8.3	3	117	-199,707	8	281	8,730.0	0	0	0.0	0	0	
30 - 35	9.7	4	159	-232,991	13	476	10,185.0	0	0	0.0	0	0	
35 - 40	11.1	3	117	-266,275	14	504	11,640.0	0	0	0.0	0	0	
40 - 45	12.5	10	378	-299,560	15	556	13,095.0	0	. 0	0.0	0	0	
45 - 50	13.9	13	466	-332,844	8	279	14,550.0	0	0	0.0	0	0	
50 - 55	15.3	17	622	-366,129	6	205	16,005.0	0	0	0.0	0	0	
55 - 60	16.7	12	453	-399,413	0	0	17,460.0	0	0	0.0	0	0	
60 - 65	18.1	8	281	-432,698	0	0	18,915.0	0	0	0.0	0	0	
65 - 70	19.5	2	80	-465,982	0	0	20,370.0	0	0	0.0	0	0	
70 - 75	20.9	0	0	-499,266	0	0	21,825.0	0	0	0.0	0	0	
75 - 80	22.3	0	0	-532,551	0	0	23,280.0	0	0	0.0	0	0	
80 - 85	23.6	0	0	-565,835	0	0	24,735.0	0	0	0.0	0	0	
85 - 90	25.0	0	0	-599,120	0	0	26,190.0	0	0	0.0	0	0	
90 - 95	26.4	0	0	-632,404	0	0	27,645.0	0	0	0.0	0	0	
95 - 100	27.8	0	0	-665,688	0	0	29,100.0	100	8,760	0.0	0	0	
Hours Off	0.0	0	5,037	0	0	5,136	0.0	0	0	0.0	0	8,760	

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

27,705

20,958

13,477

17,992

18,249

244,345

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	17,904	38	3,206	7
Feb	16,251	38	2,455	6
March	18,837	38	908	3
April	12,884	35	0	0
May	22,370	49	0	0
June	26,930	58	0	0
July	30,789	61	0	0

49

31

38

38

Building Energy Consumption = Source Energy Consumption =

Aug

Sept

0ct

Nov

Dec

Total

51,393 (Btu/Sq Ft/Year) 52,258 (Btu/Sq Ft/Year)

1,031

2,333

9,933

----- MONTHLY ENERGY CONSUMPTION -----

Floor Area = 35,555 (Sq Ft)

EKW = 530

------ UTILITY PEAK CHECKSUMS-----

Utility ELECTRIC DEMAND

Peak Value 60.6 (kW)

Yearly Time of Peak 15 (hr) 7 (mo)

Hour 15 Month 7

Eqp.	_		Utility	
Ref.	Equipment		Demand	Of Tot
Num.	Code Name	Equipment Description	(kW)	(%)
Cooling	Equipment			
1	EQ1121L	AIR-CLD RECIP 35-60 TONS	31.4	51.81
2	EQ1288S	AIR TO AIR HEAT PUMP <11 TONS	2.5	4.07
Sub Tota	al		33.8	55.88
Sub Tota	al.		0.0	0.00
Air Movi	ing Equipment			
1		SUMMATION OF FAN ELECTRICAL DEMAND	14.9	24.63
Sub Tota	al		14.9	24.63
Sub Tota	al		0.0	0.00
Miscella	aneous			
Lights			4.8	7.93
Base Ut	tilities		0.0	0.00
Misc Ec	quipment		7.0	11.55
Sub Tota	al		11.8	19.49
Grand To	otal		60.6	100.00

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ESOS STUDY AT WSMR - BUILDING 24072

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WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
BLDG AUDIT: ALT 1-BSLN, ALTS 234 -ECOS (SETBACK-SETUP T-STAT/MODIFY CONTROLS)

Weather File Code:	ELPASO).W
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)
Design Simulation Period: Jan	uary To	December
System Simulation Period: Jan		December

Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run:

Dataset Name:

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· System 1 Peak SZ - SINGLE ZONE

	Time ==>		Mo/Hr:				Mo/H	_		****** HEATI	Mo/Hr: 13/	
Outside A			-	97/ 64/ 49.	0	,	OAD			•	OADB: 24	
0215146						,	•		. *			
		ace	Ret. Air	Ret. Air	Net	Percnt *	Space	P	ercnt *	Space Peak	Coil Peak	Percnt
	Se	ns.÷Lat.	Sensible	e Latent	Total	Of Tot	Sensib	le	Of Tot *	Space Sens	Tot Sen	s Of To
Envelope	Loads	(Btuh)	(Btuh	(Btuh)	(Btuh)	(%)	(Btu	h)	(%) *	(Btuh)	(Btuh	
Skylite	Solr	0	()	0	0.00	•	0	0.00	. 0		0.0
Skylite	Cond	0	1	3	C	0.00	•	0	0.00			0.0
Roof Co	and	42,981		0	42,981	14.48	52,7	63	20.15	-60,935	-60,93	
Glass S	olar	0	f	0	0	0.00	•	0	0.00			0.0
Glass C	ond	0)	0	0.00	•	0	0.00 *			0.0
Wall Co	nd	56,722	(9	56,722	19.11	66,2		25.31 *	-		
Partiti	on	-27,680			-27,680	-9.32	-27,6	80	-10.57 *	-110,718	-110,71	8 17.3
Exposed	l Floor	0			0	0.00	•	0	0.00 *	. 0		0.0
Infiltr	ation	58,486			58,486	19.70	87,8	82	33.57	-211,356	-211,35	6 33.0
Sub Tot		130,510		o .	130,510	43.96	179,2	18	68.46 *	-534,345	-534,34	5 83.5
Internal		•			•	•	•		*	•		
Lights		46,854		0	46,854	15.78	46,8	54	17.90	. 0		0.0
People		4,020			4,020				0.91 *	. 0		0.0
Misc		31,741	1	0 0	31,741				12.12	12,000	12,00	0 -1.8
Sub Tot	al ==>	82,614		0	82,614				30.94		12,00	0 -1.8
Ceiling L		0)	,		-	0	0.00 *		1	0.0
Outside A		0		0 0	42,469			0	0.00		-117,54	3 18.3
Sup. Fan		•			39,680				0.00	•		0.0
Ret. Fan			4	0					0.00	•		0.0
Duct Heat				0	c				0.00	,		0.0
OV/UNDR S		1,594			1,594			94	0.61 *	, 0)	0 -0.0
Exhaust H	-	.,		0	. 0				0.00			0 (
Terminal				0 0	C	0.00	•		0.00	•		0 0.8
	-/,					1	•		4	•		
Grand Tot	al==>	214,718	I	0	296,867	100.00	261,8	01	100.00 *	-522,345	-639,88	8 100.0
		-										
			co	DLING COIL S	ELECTION						AREAS	
	Total (Capacity	Sens Cap.	Coil Airfl	. Enteri	ing DB/WB/HI		ng DB/		Gross Total		(sf) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	g F Grain	s Deg F D	eg F	Grains		, 125	
Main Clg	24.7	296.9	341.0	2900	80.0 59.	2 54.3	66.7 55	.3	57.6 F	ert 23,5	74	
Aux Clg	0.0	0.0	0.0	0	0.0	0.0 0.0	0.0	0.0	0.0	Exflr	0	
Opt Vent	0.0	0.0	0.0	0	0.0	0.0 0.0	0.0	0.0	0.0	Roof 12	,463	0
Totals	24.7	296.9								Wall 6	,408	0
										OUECKO	TCWDEBATI	DE@ /E\
			ECTION			RFLOWS (cfi				CHECKS	TEMPERATU	
	Capacity			_	Туре	Cooling	Heating	_	% OA	10.0		lg Htg
_	(Mbh)	(cf	-		Vent	2,790	2,790	-	Cfm/Sqft	0.84		8.2 87.
lain Htg	-639.9	•			Infil	5,017	5,017		Cfm/Ton	1127.78		8.0 68.
ux Htg	0.0		0 0.		Supply	27,900	27,900	_	Sqft/Ton	1338.98		8.0 68.
reheat	-0.0	_			Mincfm	0	0	-	Btuh/Sqf1			0.0 63.
	0.0		0 0.		Return	27,900	27,900		People	9		8. 0 68.
						2 700	2 700	44	7 08	10.0	Fn MtrTD	0.4 0.
Reheat Iumidif	0.0		0 0.		Exhaust	2,790	2,790	Htg				
	0.0 0.0 -639.9)	0 0.		Exnaust Rm Exh Auxil	0	0	Htg	Cfm/SqFt Btuh/SqFt	0.84	Fn BldTD	0.3 0. 0.8 0.

-16,204

100.00

-16,204

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Grand Total==>

42,174

0

0

INCHP - INCREMENTAL HEAT PUMP Peak System Mo/Hr: 7/16 Mo/Hr: 13/ 1 Peaked at Time ==> Mo/Hr: 7/16 OADB: 24 OADB/WB/HR: 97/ 64/ 49.0 OADB: 97 Outside Air ==> Coil Peak Space Ret. Air Ret. Air Net Percnt Space Percnt * Space Peak Percnt Sensible Of Tot * Space Sens Tot Sens Of Tot Sens.+Lat. Sensible Latent Total Of Tot (Btuh) (%) (Btuh) (%) (Btuh) (%) Envelope Loads (Btuh) (Btuh) (Btuh) (Btuh) 0 0.00 0 0 0.00 0.00 Skylite Solr 0 0 n 0.00 0 Ω 0.00 0.00 n Skylite Cond 0 0 0 15.39 -8,554 -8,554 52.79 Roof Cond 6,182 0 6,182 14.51 6,182 0.00 0 0.00 0 0.00 0 0 0 Glass Solar 0.00 0 0.00 0.00 0 Ω 0 Glass Cond 0 0 0.00 0 0.00 0.00 0 n Wall Cond 0 23.52 1.19 -3,811 -3,811 476 1.12 476 Partition 476 0.00 0 0.00 Exposed Floor 0 0 0.00 0 0 Infiltration 6.20 1,946 4.84 -3,839 -3,839 23.69 2,641 2,641 -16,204 -16,204 100.00 21.83 8,604 21.41 9,299 0 9,299 Sub Total==> Internal Loads 26,048 26,048 64.83 0 0 0.00 26,048 61.14 Lights 0 0.00 2,680 1,380 3.43 n 0 People 2,680 6.29 4,147 0 0 4,147 9.73 * 4,147 10.32 0 0 0.00 Misc Sub Total ==> 32,875 0 32,875 77.17 * 31,575 78.59 0 0.00 0.00 0 0.00 Ceiling Load 0 0 0 0.00 0.00 0 0.00 0.00 Outside Air Û 0 0 0.00 0.00 1.00 Sup. Fan Heat 427 0.00 0 0.00 Ret. Fan Heat 0 0 0.00 Duct Heat Pkup 0 0.00 0.00 0 0.00 0.00 0.00 0.00 OV/UNDR Sizing 0.00 0.00 0 0 0.00 Exhaust Heat 0 0.00 0.00 0.00 n O 0 Terminal Bypass

		AREAS														
	Total Capacity		Total Capacity Sens Cap. Coil Air		Coil Airfl	Entering DB/WB/HR			Leaving DB/WB/HR			Gross Total		Glass (sf)	(%)	
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F	Deg F	Grains	Deg F	Deg F	Grains	Floor	2,430				
Main Clg	3.6	42.6	40.6	1,200	75.2	53.4	36.2	39.8	36.9	32.9	Part	711				
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	0				
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	2,430	0	0)	
Totals	3.6	42.6									Wall	0	(0	Ì	

42,601 100.00 *

40,179

100.00 *

********	HEATING COIL SELECTION					AIRFLOWS (cfm)				CHECKS	TEMPERATURES (F)			
	Capacity	Coil Airfl	Ent	Lvg	Type	Cooling	Heating	Clg	% OA	0.0	Type	Clg	Htg	
	(Mbh)	(cfm)	Deg F	Deg F	Vent	0	0	Clg	Cfm/Sqft	0.49	SADB	40.0	82.1	
Main Htg	-25.8	1,200	59.6	82.1	Infil	91	91	Clg	Cfm/Ton	338.02	Plenum	75.0	68.0	
Aux Htg	0.0	0	0.0	0.0	Supply	1,200	1,200	Clg	Sqft/Ton	684.50	Return	75.0	68.0	
Preheat	-0.0	1,200	68.0	39.7	Mincfm	0	0	Clg	Btuh/Sqft	17.53	Ret/OA	75.0	68.0	
Reheat	0.0	0	0.0	0.0	Return	1,200	1,200	No.	People	4	Runarnd	75.0	68.0	
Humidif	0.0	0	0,0	0.0	Exhaust	0	0	Htg %	OA	0.0	Fn MtrTD	0.1	0.0	
Opt Vent	0.0	0	0.0	0.0	Rm Exh	0	0	Htg	Cfm/SqFt	0.49	Fn BldTD	0.1	0.0	
Total	-25.8				Auxil	0	0	Htg	Btuh/SqFt	-10.62	Fn Frict	0.2	0.0	

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

BUILDING U-VALUES - ALTERNATIVE 3
SETBACK

------ BUILDING U-VALUES------

					Roc						Room	Room
Room Number	Description	Dart	ExFlr	Summr Skylt	Wintr	ı/hr/sqf Roof	Summr	Wintr Windo	l leU	Ceil.	Mass (lb/ sqft)	Capac. (Btu/ sqft/F)
Haibei	Description		LAI (I	JAYEE	JAYEE	ROOT	#11.60	WIING	watt	00111	341 67	341 (717
1	2ND FLR- GRD LVL	0.000	0.000	0.000	0.000	0.130	0.000	0.000	0.610	0.000	169.8	34.74
Zone	1 Total/Ave.	0.000	0.000	0.000	0.000	0.130	0.000	0.000	0.610	0.000	169.8	34.74
2	1ST FLR MEZZ LVL	0.470	0.000	0.000	0.000	0.080	0.000	0.000	0.422	0.000	104.5	21.21
Zone	2 Total/Ave.	0.470	0.000	0.000	0.000	0.080	0.000	0.000	0.422	0.000	104.5	21.21
3	BASEMENT	0.602	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	161.1	32.23
Zone	3 Total/Ave.	0.602	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	161.1	32.23
System	1 Total/Ave.	0.587	0.000	0.000	0.000	0.111	0.000	0.000	0.537	0.000	143.4	28.97
4	1ST FLR OFC AREA	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
Zone	4 Total/Ave.	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
System	2 Total/Ave.	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
Buildin	g	0.590	0.000	0.000	0.000	0.106	0.000	0.000	0.537	0.000	141.9	28.72

BUILDING AREAS - ALTERNATIVE 3
SETBACK

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Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	_	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	2ND FLR- GRD LVL	1	1	7,757	7,757		0	0 0		7,757	0 0	3	,906
Zone	1 Total/Ave.				7,757	0	0	0	0	7,757	0	0	3,906
2	1ST FLR MEZZ LVL	1	1	11,568	11,568	2,706	0	0	0	4,706	0	0	2,502
Zone	2 Total/Ave.				11,568	2,706	0	0	0	4,706	0	0	2,502
3	BASEMENT	1	1	13,800	13,800	20,868	0	0	0	0	0	0	0
Zone	3 Total/Ave.				13,800	20,868	0	0	0	0	0	0	0
System	1 Total/Ave.				. 33, 125	23,574	0	0	0	12,463	0	0	6,408
4	1ST FLR OFC AREA	1	1	2,430	2,430	711	0	0	0	2,430	0	0	0
Zone	4 Total/Ave.				2,430	711	0	0	0	2,430	0	0	0
System	2 Total/Ave.				2,430	711	0	0	0	2,430	0	0	0
Buildin	g				35,555	24,285	0	0	0	14,893	0	0	6,408

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 3

System Totals

<u>વ્યવસાયમાં</u>

Percent	Cool	ling Loa	d	Heatir	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	1.4	22	1,324	-33,284	17	254	1,455.0	0	0	0.0	0	0
5 - 10	2.8	16	1,007	-66,569	12	169	2,910.0	0	0	0.0	0	0
10 - 15	4.2	26	1,567	-99,853	9	130	4,365.0	0	0	0.0	0	0
15 - 20	5.7	2	136	-133,138	5	74	5,820.0	0	0	0.0	0	0
20 - 25	7.1	9	550	-166,422	7	109	7,275.0	0	0	0.0	0	0
25 - 30	8.5	4	272	-199,707	3	49	8,730.0	0	. 0	0.0	0	0
30 - 35	9.9	1	59	-232,991	6	84	10,185.0	0	0	0.0	0	0
35 - 40	11.3	1	79	-266,275	3	47	11,640.0	0	0	0.0	0	0
40 - 45	12.7	1	70	-299,560	5	69	13,095.0	0	0	0.0	0	0
45 - 50	14.1	2	109	-332,844	4	60	14,550.0	0	0	0.0	0	0
50 - 55	15.6	1	59	-366,129	0	4	16,005.0	0	0	0.0	0	0
55 - 60	17.0	5	298	-399,413	0	4	17,460.0	0	0	0.0	0	0
60 - 65	18.4	5	301	-432,698	3	38	18,915.0	0	0	0.0	0	0
65 - 70	19.8	1	70	-465,982	0	4	20,370.0	0	0	0.0	0	0
70 - 75	21.2	2	142	-499,266	1	16	21,825.0	0	0	0.0	0	0
75 - 80	22.6	0	0	-532,551	1	19	23,280.0	0	0	0.0	0	0
80 - 85	24.0	0	15	-565,835	3	38	24,735.0	0	0	0.0	0	0
85 - 90	25.5	0	0	-599,120	1	14	26,190.0	0	0	0.0	0	0
90 - 95	26.9	0	28	-632,404	7	98	27,645.0	0	0	0.0	0	0
95 - 100	28.3	0	30	-665,688	13	185	29,100.0	100	8,760	0.0	0	0
Hours Off	0.0	0	2,644	0	0	7,295	0.0	0	0	0.0	0	8,760

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3

406-l-1664₀5-1-65.

 мо	N	Т	Н	L	, I	E N	E	RG	Y	C	0	N S	s u	M	Ρ	T	1 () N	

	ELEC	DEMAND	GAS	GAS DMND						
	On Peak	On Peak	On Peak	On Peak						
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)						
Jan	31,742	53	1,743	10						
Feb	28,369	53	1,313	11						
March	32,452	53	309	9						
					April	2	8,558	47	0	2
May	33,258	67	0	0						
June	38,222	77	0	0						
July	41,646	80	0	0						
Aug	39,398	76	0	0						
Sept	31,905	67	0	0						
Oct	29,610	63	0	0						
Nov	30,826	53	399	9						
Dec	31,061	53	1,132	10						
Total	397,046	80	4,897	11						
Building Energ	y Consumption	= 51,8	87 (Btu/Sq	Ft/Year)		Floor Area	=	35,555 (Sq Ft)		
Source Energy	Consumption	= 52,3	13 (Btu/Sq	Ft/Year)						

EKW=695

D17-28

UTILITY PEAK CHECKSUMS - ALTERNATIVE 3

------ UTILITY PEAK CHECKSUMS------

Utility ELECTRIC DEMAND

Peak Value 79.7 (kW)

Yearly Time of Peak 15 (hr) 7 (mo)

Hour 15 Month 7

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Eqp.			Utility	Percnt	
Ref.	Equipment		Demand	Of Tot	
Num.	Code Name	Equipment Description	(kW)	(%)	
Cooling	Equipment				
1	EQ1121L	AIR-CLD RECIP 35-60 TONS	31.7	39.76	
2	EQ1288S	AIR TO AIR HEAT PUMP <11 TONS	4.7	5.93	
Sub Tota	ι		36.4	45.68	
Sub Tota	t		0.0	0.00	
Air Movi	ng Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	14.9	18.73	
Sub Tota	ι		14.9	18.73	
Sub Tota	ι		0.0	0.00	
Miscella	neous				
Lights			21.4	26.81	
Base Ut	ilities		0.0	0.00	
Misc Eq	uipment		7.0	8.78	
Sub Tota	Į.		28.4	35.59	
Grand To	tal		79.7	100.00	

D17-30

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Trane Air Conditioning Economics

By: Trane Customer Direct Service Network
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ESOS STUDY AT WSMR - BUILDING 24072
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
BLDG AUDIT: ALT 1 / DRY-BULB ECONOMIZER

Weather	File	Code:	ELPASO.W
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Locat	ion:
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anting the

Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)

Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	

Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft)

Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	0.9575	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,214.8	(Btu-min./hr/cuft)
Enthalpy Factor:	3.9171	(Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 11

11:15:31 6/17/92

Dataset Name:

24072EC .TM

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

Grand Total ==>

240,156

a

0

- SINGLE ZONE SZ System 1 Peak Mo/Hr: 13/ 1 Mo/Hr: 7/16 Mo/Hr: 7/16 Peaked at Time ==> QADB: 24 OADB: 97 OADB/WB/HR: 97/ 64/ 49.0 Outside Air ==> Coil Peak Net Percnt * Percnt * Space Peak Percnt Ret. Air Ret. Air Space Space Total Of Tot * Of Tot * Space Sens Tot Sens Of Tot Sensible Sensible Sens.+Lat. Latent (Btuh) (%) (%) * (Btuh) (%) * (Btuh) (Btuh) (Btuh) (Btuh) (Btuh) Envelope Loads 0.00 * 0 n 0.00 0.00 * 0 Skylite Solr 0 0 0 0 0.00 0.00 * 0.00 * 0 Skylite Cond 0 0 0 -60,935 -60,935 17.18 * 9.52 47,136 15.07 * 56,918 47,136 0 Roof Cond 0.00 * 0 G 0.00 0.00 * 0 Glass Solar 0 0 0 0.00 * 0 0.00 0.00 * 0 Glass Cond 0 0 0 23.12 * -151,335 -151,335 23.65 21.44 * 76,571 0 67,040 Wall Cond 67,040 4.18 * -110,718 -110,718 17.30 13,840 4.43 * 13,840 13.840 Partition 0.00 * 0 0 0.00 0 0.00 * 0 Exposed Floor 0 30.88 * -211,356 -211,356 33.03 9.23 * 102,293 28,877 Infiltration 28,877 75.36 * -534,345 -534,345 83.51 249,621 156,893 50.17 * Sub Total==> 156,893 Internal Loads 0.00 46,854 14.98 * 46,854 14.14 * 0 0 Lights 46,854 0 0.72 * 0 0.00 1.29 * 2,394 4,020 People 4,020 9.58 * 12,000 12,000 -1.88 10.15 * 31,741 31,741 0 0 31,741 Misc 24.45 * 12,000 12,000 -1.88 82,614 26.42 * 80,989 Sub Total ==> 82,614 0 0 0 0.00 * 0 0.00 * 0.00 Ceiling Load 0 0 0 0 0.00 * 0 -117,543 18.37 32,869 10.51 * 0 0 Outside Air 39,680 12.69 0.00 * 0 0.00 Sup. Fan Heat 0 0.00 * 0.00 * 0.00 Ret. Fan Heat 0 0.00 * 0 0.00 0 0.00 * Duct Heat Pkup 0 0.20 * 649 0.21 * 649 0 OV/UNDR Sizing 0 0.00 * 0.00 * Exhaust Heat 0.00 * 0.00 0 0 0.00 * Terminal Bypass

-----AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Gross Total Glass (sf) (%) Leaving DB/WB/HR Deg F Deg F Grains Deg F Deg F Grains Floor 33,125 (Tons) (Mbh) (Mbh) (cfm) 61.1 56.2 23,574 70.7 Main Clg 26.1 312.7 418.5 27,900 77.3 60.3 63.8 Part 0.0 0.0 0 0.0 ExFlr Aux Clg 0.0 0.0 0.0 0 0.0 0.0 0.0 0 0.0 12,463 0 0 0.0 0.0 0.0 0.0 0.0 Roof Opt Vent 0.0 0.0 0.0 Wall 6,408 Totals 26.1 312.7

312,706 100.00 *

100.00 *

331,259

-522,345

-639,888 100.00

	HEATING	COIL SELECTIO)N		А	IRFLOWS (cf	m)	ENGINEERING	CHECKS	TEMPERA	TURES	(F)
	Capacity	Coil Airfl	Ent	Lvg	Type	Cooling	Heating	Clg % OA	10.0	Type	Clg	Htg
	(Mbh)	(cfm)	Deg F	Deg F	Vent	2,790	2,790	Clg Cfm/Sqft	0.84	SADB	62.6	87.6
Main Ktg	-639.9	27,900	63.6	87.6	Infil	5,017	5,017	Clg Cfm/Ton	1070.66	Plenum	75.0	68.0
Aux Htg	0.0	0	0.0	0.0	Supply	27,900	27,900	Clg Sqft/Ton	1271.16	Return	75.0	68.0
Preheat	-0.0	27,900	63.6	61.1	Mincfm	0	0	Clg Btuh/Sqft	9.44	Ret/OA	77.3	63.6
Reheat	0.0	0	0.0	0.0	Return	27,900	27,900	No. People	9	Runarnd	75.0	68.0
Humidif	0.0	0	0.0	0.0	Exhaust	2,790	2,790	Htg % OA	10.0	Fn MtrTD	0.4	0.0
Opt Vent	0.0	0	0.0	0.0	Rm Exh	0	0	Htg Cfm/SqFt	0.84	Fn BldTD	0.3	0.0
Total	-639.9				Auxil	0	0	Htg Btuh/SqFt	-19.32	fn Frict	0.8	0.0

data di data di data di data di data di data di data di data di data di data di data di data di data di data di

Humidif

Total

Opt Vent

0.0

0.0

-25.8

0

0

0.0

0.0

0.0

0.0

Exhaust

Rm Exh

Auxil

System	2	Peak	INCHP	- INCREMEN	ITAL HEAT P	PUMP							
*****	*****	****** C	OOLING COIL	PEAK *****	******	****				***** HEA			*****
Peaked at	t Time =	:=>	Mo/Hr: 7	7/16		1		Hr: 7			Mo/Hr: 13		
Outside /	Air ==>	OA	DB/WB/HR: 9	77/ 64/ 49.0)	•	* OA	DB: 9	97 *		OADB: 2	24	
		_					•		*	0 0-	ale Cail I	1.	0
		Space	Ret. Air	Ret. Air		Percnt	•	ace	Percnt *	Space Pe			Percni
		Sens.+Lat.	Sensible	Latent	Total		* Sensi		Of Tot *	Space Se			Of Tot
Envelope		(Btuh)	(Btuh)	(Btuh)	(Btuh)		* (B1	:uh)	(%) *	(Btu		tuh)	(%)
Skylite	e Solr	0	0		0			0	0.00 *		0	0	0.00
Skylite		0	0		0			0	0.00 *		0	0	0.00
Roof Co		6,182	0		6,182		•	182	15.39 *	-8,5		,554	52.79
Glass	Solar	0	0		C		•	0	0.00 *		0	0	0.00
Glass	Cond	0	0		C		•	0	0.00 *		0	0	0.00
Wall Co	ond	0	0		C		*	0	0.00 *		0	0	0.00
Partit	ion	476			476		*	476	1.19 *	-3,8		,811	23.52
Expose	d Floor	0			C		*	0	0.00 *		0	0	0.00
Infilt	ration	2,641			2,641	6.20	* 1,	,946	4.84 *	-3,8	39 -3,	,839	23.69
Sub To	tal==>	9,299	0		9,299	21.83	* 8,	604	21.41 *	-16,2	04 -16,	,204	100.00
Internal	Loads					,	*		*				
Lights		26,048	0		26,048	61.14	* 26,	,048	64.83 *		0	0	0.00
People		2,680			2,680	6.29	• 1,	,380	3.43 *		0	0	0.00
Misc		4,147	0	0	4,147	9.73	* 4,	,147	10.32 *		0	0	0.00
Sub To	tal==>	32,875	0	0	32,879	77.17	* 31,	,575	78.59 *		0	0	0.00
Ceiling i	Load	0	0		. (0.00	*	0	0.00 *		0	0	0.00
Outside /	Air	0	0	0	(0.00	•	0	0.00 *		0	0	0.00
Sup. Fan	Heat				427	7 1.00	*		0.00 *			0	0.00
Ret. Fan	Heat		0		(0.00	*		0.00 *			0	0.00
Duct Hea	t Pkup		0		(0.00	*		0.00 *			0	0.00
OV/UNDR	Sizing	0			(0.00	k	0	0.00 *		0	0	0.00
Exhaust	Heat		0	0	(0.00	•		0.00 *			0	0.00
Terminal	Bypass		0	0	(0.00	*		0.00 *			0	0.00
							*		*				
Grand To	tal==>	42,174	0	0	42,601	100.00	* 40,	,179	100.00 *	-16,2	04 -16,	,204	100.00
	• • • • • • • •		C00	LING COIL S	ELECTION						AREAS-		
	Total	l Capacity	Sens Cap.	Coil Airfl	Enteri	ing DB/WB/H	R Leav	∕ing D	B/WB/HR	Gross Tot	al Glas	ss (sf	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	eg F Grain	s Deg f	Deg F	Grains	Floor	2,430		
Main Clg	3.6	42.6	40.6	1,200	75.2	36.	2 39.8	36.9	32.9	Part	711		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0 0.	0.0	0.0	0.0	ExFlr	0		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0 0.	0.0	0.0	0.0	Roof	2,430		0 0
otals (3.6	42.6								Wall	0		0 (
	KEAT	ING COIL SEL	ECTION		A1	IRFLOWS (cf	m)		ENGINEERING	CHECKS	TEMPER	ATURES	(F)
	Capac	ity Coil A	irfl Ent	Lvg	Type	Cooling	Heating	CL	g % OA	0.0	Type	Clg	Htg
	(Mbi	h) (cf	m) Deg F	Deg F	Vent	0	0	CL	g Cfm/Sqft	0.49	SADB	40.0	82.1
lain Htg	-25	5.8 1,	200 59.6	82.1	Infil	91	91	CL	g Cfm/Ton	338.02	Plenum	75.0	68.0
Aux Htg	(0.0	0 0.0	0.0	Supply	1,200	1,200	CL	g Sqft/Ton	684.50	Return	75.0	68.0
Preheat			200 68.0	39.7	Mincfm	. 0	. 0		g Btuh/Sqft		Ret/OA	75.0	
Reheat		0.0	0 0.0		Return	1,200	1,200		. People	4	Runarnd	75.0	
	`												

0

0

0

0

0

0

Htg % OA

Htg Cfm/SqFt

Htg Btuh/SqFt

0.0

0.49

-10.62

Fn MtrTD

Fn BldTD

Fn Frict

0.1

0.1

0.2

0.0

0.0

0.0

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

BUILDING U-VALUES - ALTERNATIVE 1
DRY-BULB ECONOMIZER - BLDG 24072

-----BUILDING U-VALUES------

	Room U-Values								Room	Room		
					(Btu	/hr/sqf	t/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	Exfir	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	2ND FLR- GRD LVL	0.000	0.000	0.000	0.000	0.130	0.000	0.000	0.610	0.000	169.8	34.74
Zone	1 Total/Ave.	0.000	0.000	0.000	0.000	0.130	0.000	0.000	0.610	0.000	169.8	34.74
2	1ST FLR MEZZ LVL	0.470	0.000	0.000	0.000	0.080	0.000	0.000	0.422	0.000	104.5	21.21
Zone	2 Total/Ave.	0.470	0.000	0.000	0.000	0.080	0.000	0.000	0.422	0.000	104.5	21.21
3	BASEMENT	0.602	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	161.1	32.23
Zone	3 Total/Ave.	0.602	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	161.1	32.23
System	1 Total/Ave.	0.587	0.000	0.000	0.000	0.111	0.000	0.000	0.537	0.000	143.4	28.97
4	1ST FLR OFC AREA	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
Zone	4 Total/Ave.	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
System	2 Total/Ave.	0.670	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	122.1	25.32
Buildin	g	0.590	0.000	0.000	0.000	0.106	0.000	0.000	0.537	0.000	141.9	28.72

BUILDING AREAS - ALTERNATIVE 1
DRY-BULB ECONOMIZER - BLDG 24072

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Floor Total Exposed Number of Area/Dupl Floor Partition Floor Skylight Skl Net Roof Window Win Net Wall Room Duplicate Room Area Area Area Area /Rf Area Area /Wl Area Number Description Flr Rm (sqft) (sqft) (sqft) (sqft) (sqft) (%) (sqft) (sqft) (%) (sqft) 1 2ND FLR- GRD LVL 7,757 7,757 0 0 O 7,757 0 3,906 0 0 7,757 Zone 1 Total/Ave. 0 0 0 7,757 0 0 3,906 2 1ST FLR MEZZ LVL 11,568 11,568 2,706 4,706 2,502 2 Total/Ave. 11,568 2,706 0 0 4,706 2,502 Zone 0 0 3 BASEMENT 13,800 13,800 20,868 0 0 0 0 0 0 3 Total/Ave. 13,800 Zone 20,868 0 0 0 0 0 0 System 1 Total/Ave. 33,125 23,574 0 0 12,463 0 0 6,408 4 1ST FLR OFC AREA 2,430 2,430 711 0 0 2,430 0 0 Zone 4 Total/Ave. 2,430 711 0 0 0 2,430 0 0 0 System 2 Total/Ave. 2,430 711 O 0 2,430 0 0 n 0 Building 35,555 24,285 O 14,893 0 6,408

SYSTEM LOAD PROFILE - ALTERNATIVE 1

Main System

1 SZ

SINGLE ZONE

Percent	Cool	ing Loa	d	Heatir	ng Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	1.3	5	168	-31,994	9	320	1,395.0	0	0	0.0	0	0
5 - 10	2.6	7	271	-63,989	10	364	2,790.0	0	0	0.0	0	0
10 - 15	3.9	4	164	-95,983	9	331	4,185.0	0	0	0.0	0	0
15 - 20	5.2	2	71	-127,978	10	379	5,580.0	0	0	0.0	0	0
20 - 25	6.5	2	81	-159,972	9	335	6,975.0	0	0	0.0	0	0
25 - 30	7.8	3	120	-191,967	11	390	8,370.0	0	0	0.0	0	0
30 - 35	9.1	3	126	-223,961	19	687	9,765.0	0	0	0.0	0	0
35 - 40	10.4	4	144	-255,955	9	322	11,160.0	0	0	0.0	0	0
40 - 45	11.7	4	136	-287,950	7	249	12,555.0	0	0	0.0	0	0
45 - 50	13.0	7	241	-319,944	7	247	13,950.0	0	0	0.0	0	0
50 - 55	14.3	12	437	-351,939	0	0	15,345.0	0	0	0.0	0	0
55 - 60	15.6	8	290	-383,933	0	0	16,740.0	0	0	0.0	0	0
60 - 65	16.9	23	851	-415,927	0	0	18,135.0	0	0	0.0	0	0
65 - 70	18.2	7	262	-447,922	0	0	19,530.0	0	0	0.0	0	0
70 - 75	19.5	8	310	-479,916	0	0	20,925.0	0	0	0.0	0	0
75 - 8 0	20.8	0	0	-511,911	0	0	22,320.0	0	0	0.0	0	0
80 - 85	22.1	0	0	-543,905	0	0	23,715.0	0	0	0.0	0	0
85 - 90	23.5	0	0	-575,900	0	0	25,110.0	0	0	0.0	0	0
90 - 95	24.8	0	0	-607,894	0	0	26,505.0	0	0	0.0	0	0
95 - 100	26.1	0	0	-639,888	0	0	27,900.0	100	8,760	0.0	0	0
Hours Off	0.0	0	5,088	0	0	5,136	0.0	0	0	0.0	0	8,760

Main System

4030000 - 1000

2 INCHP

INCREMENTAL HEAT PUMP

Percent	Cool	ing Loa	d	Heatir	ng Load		Cooling	Airflow	0000	Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	0.2	0	0	-1,290	0	0	60.0	0	0	0.0	0	. 0
5 - 10	0.4	0	0	-2,580	0	0	120.0	0	0	0.0	0	0
10 - 15	0.5	0	0	-3,870	0	0	180.0	0	0	0.0	0	0
15 - 20	0.7	0	0	-5,160	0	0	240.0	0	0	0.0	0	0
20 - 25	0.9	1	59	-6,450	0	0	300.0	0	0	0.0	0	0
25 - 30	1.1	6	501	-7,740	0	0	360.0	0	0	0.0	0	0
30 - 35	1.2	12	1,055	-9,030	0	0	420.0	0	0	0.0	0	0
35 - 40	1.4	9	804	-10,320	0	0	480.0	0	0	0.0	0	0
40 - 45	1.6	9	749	-11,610	0	0	540.0	0	0	0.0	0	0
45 - 50	1.8	6	533	-12,900	0	0	600.0	0	0	0.0	0	0
50 - 55	2.0	8	667	-14,190	0	0	660.0	0	0	0.0	0	0
55 - 60	2.1	6	564	-15,480	0	0	720.0	0	0	0.0	0	0
60 - 65	2.3	7	589	-16,770	0	0	780.0	0	0	0.0	0	0
65 - 70	2.5	7	581	-18,060	0	0	840.0	0	0	0.0	0	0
70 - 75	2.7	10	836	-19,350	0	0	900.0	0	0	0.0	0	0
75 - 80	2.8	6	496	-20,640	0	0	960.0	0	0	0.0	0	0
80 - 85	3.0	8	673	-21,930	0	0	1,020.0	0	0	0.0	0	0
85 - 90	3.2	4	369	-23,220	0	0	1,080.0	0	0	0.0	0	0
90 - 95	3.4	3	224	-24,510	0	0	1,140.0	0	0	0.0	0	0
95 - 100	3.6	1	60	-25,800	0	0	1,200.0	100	8,760	0.0	0	0
Hours Off	0.0	0	0	0	0	8,760	0.0	0	0	0.0	0	8,760

------ MONTHLY ENERGY CONSUMPTION ------

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	34,927	53	2,610	6
Feb	31,774	53	1,832	6
March	35,974	53	244	3
April	29,012	46	0	0
May	39,436	68	0	0
June	44,708	79	0	0
July	49,798	82	0	0
Aug	46,492	79	0	0
Sept	37,566	67	0	0
Oct	30,039	55	0	0
Nov	34,172	53	317	3
Dec	35,798	53	1,585	4
Total	449,695	82	6,590	6

Building Energy Consumption = Source Energy Consumption =

61,701 (Btu/Sq Ft/Year) 62,274 (Btu/Sq Ft/Year)

Floor Area = 35,555 (Sq Ft)

2Kw= 741

D17-36

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UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

------ UTILITY PEAK CHECKSUMS-----

Utility ELECTRIC DEMAND

Peak Value 82.2 (kW)

Yearly Time of Peak 15 (hr) 7 (mo)

Hour 15 Month 7

สมสัตร์การเกรา

Hour 15	Month 7			
Eqp.			Utility	Percnt
Ref.	Equipment		Demand	Of Tot
Num.	Code Name	Equipment Description	(kW)	(%)
Cooling	Equipment			
1	EQ1121L	AIR-CLD RECIP 35-60 TONS	34.3	41.74
2	EQ1288S	AIR TO AIR HEAT PUMP <11 TONS	4.6	5.61
Sub Tota	nt		38.9	47.35
Sub Tota	at		0.0	0.00
Air Movi	ing Equipment			
1		SUMMATION OF FAN ELECTRICAL DEMAND	14.9	18.15
Sub Tota	ıl		14.9	18.15
Sub Tota	nl		0.0	0.00
Miscella	ineous			
Lights			21.4	25.98
	ilities		0.0	0.00
	uipment .	•	7.0	8.51
Sub Tota	ıl		28.4	34.50
Grand To	tal		82.2	100.00

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

BLOG. 24072 LIGHTING ECO

- BASEMENT
 - · Illumination Regulared = 5 foot candles (similar to storage lighting)
 - · Lumens / fixture = 5300 lumens (2-34WAHT 4ft lamps)
 - · Reflectance Color = Grey
 - . h = height from Lighting fixture to floor = 10 St.
 - . Total S.F. = 9380 S.F.
 - · Length & Width of Area = Perimeter + Z = 250 ft.

Calculations

Room Cavity Ratio (RCR) =
$$\frac{(5)(10')(250')}{93805.F.} = 1.33$$

Regulated # of Fixtures =
$$\frac{(9380 \text{ S.F.})(5 \text{ fc})}{(5300 \text{ limens})(0.65)(0.63)} = 21.6 = 22 \text{ fixtures}$$

Material List

- · 4' energy efficient lamps: 44
- · Energy efficient bullasts: 22
- Lighting Branch Circuit: A = 298 ft. (east) 552 ft. B = 254 ft. (west)
- · 2 Lighting switches

Schedule of Operation

I hr. por day, 5 days per week

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

BLOG. 24072 LIGHTING ECO

JOB WSMR Prof. No.	1110-000
SHEET NO.	② of 5
CALCULATED BY A. J. N.	DATE 6-12-92
CHECKED BY	DATE
SCALE	

Ground Floor Office Area/Lounge

- . Illumination Required = 25 foot candles
- · Lumens/fixture = 5300 lumens
- · Reflectance Color = Off white
- . h = 9 st.
- · Total S.F. = 3,240 \$
- · Length & Width of Area = 126 A.

Calculations

$$RCR = \frac{(5)(9')(1264)}{3240 \text{ s.f.}} = 1.75$$

Regulared # of Fixtures =
$$\frac{(3240 \text{ s.f.})(25 \text{ fc})}{(5300 \text{ lumens})(0.65)(0.59)} = 39.85 = 40 \text{ fixtures}$$

Material List

- . 4' energy efficient lamps: 68
- · Energy efficient ballasts: 34
- Lighting Branch Circuits:
 (1) 190 ft.
 (2) 134 ft.
 (3) 120 ft
- · Lighting Switches: 4

Schedule of Operation

8 hrs. por day, 5 days per week.

	JOB WSMR Prof. No.	1110-000
	SHEET NO.	3) of <u>5</u>
E M C ENGINEERS, INC.	CALCULATED BY A.J.N.	DATE 6-12-92
Denver • Colorado Springs • Atlanta • Germany	CHECKED BY	DATE
BLDG 24072 Lighting ECO	SCALE	

GROUND FLOOR WORK AREA

· Rewire / Relamp all fluorescent fixtures (except 8 fixtures).

Material List

- · 4'energy efficient lamps: 46
- · Energy efficient ballasts: 23
- Lighting Branch Circuits: (1) 252ft 337ft.
- · Lighting Switches: 2

Schedule of Operation 8 hrs per day, 5 days per week

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

BLDG. 24072 LIGHTING ECO

JOB WSMR Prod	No. 1110-000
SHEET NO.	4 OF 5
CALCULATED BY A J.N.	DATE 6-/2-92
CHECKED BY	DATE
SCALE	`

MEZZANINE STORAGE/WORK AREA

- · Illumination Required = 15 foot candles
- · Lumens/fixture = 5300 lumens.
- · Reflectance Color = Grey
- · h = 9 A.
- Tór. S.F. = 2986 S.F.
- · Length & Width of Aven. = 112 ft.

Calculations

$$RCR = \frac{(5)(94)(1124)}{29865.5} = 1.69$$

CU = 0.60 from Fig. 9-62

Material List

- · 4 energy efficient lamps: 46
- · Energy efficient ballasts: 23
- Lighting Branch Circuits: 147ff (west) } 372ft.
 225ft (east)
- · Lighting Switches : 2

Schedule of Operation

2 kms perday, 5 days per week.

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

BLDG. 24872 LIGHTING ECO

JOB WSMR	Proj. No 1110-000
SHEET NO.	<u>(3)</u> of <u>5</u>
CALCULATED BY A.J.N.	DATE 6-12-92
CHECKED BY	DATE
SCALE	

SECOND FLOOR (TOP FLOOR)

- · Illumination Required = 10 foot candes. (Similar to corridor lighting)
- * Lumens / fixture = 5300 lumens.
- · Reflectance Color = Grey
- h = 9 A.
- . Total S.F. = 2489 S.F.
- · Length & Width of Area = 144 ft.

Calculations.

$$RCR = \frac{(5)(9')(144 \text{ pt.})}{2489 \text{ s.f.}} = 2.6$$

Material List

- · 4'energy efficient lamps: 30
- · Energy efficient ballasts: 15
- · Lighting branch circuit: 283 St.
- · Lighting switches : 2

Schedule of Operation

I hr. perday, 5 days per week.

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reaching the work-plane, divided by the area of the work-plane. The average value determined this way may vary considerably from that obtained by averaging discrete values of illuminance at several points.

In addition to measurement uncertainties, calculated illuminance values may differ from measured values due to luminaire input data, assumed room and system parameters and mathematical modeling of the lighting system. For example: individual lamps may vary from nominal ratings; individual luminaires may differ from the nominal photometric data due to manufacturing and lamp positioning differences; and assumed values for room reflectances and ballast factor may vary from actual values. In addition, the mathematical model is not an exact representation of most real rooms. For a complete discussion of uncertainties, see reference 25.

Calculation Procedure. Fig. 9-36 provides a procedure for calculating average maintained illuminance using the Zonal-Cavity Method.²²⁻²⁴ The paragraphs that follow discuss the calculation of cavity ratios and effective cavity reflectances and the selection of luminaire coefficients of utilization to be used in the Method.

Cavity Ratios. In the Zonal-Cavity Method, the effects of room proportions, luminaire suspension length, and work-plane height upon the coefficient of utilization are respectively accounted for by the Room Cavity Ratio, Ceiling Cavity Ratio and Floor Cavity Ratio. These ratios are determined by dividing the room into three cavities as shown by Fig. 9–37 and substituting dimensions (in feet or meters) in the following formula:

Cavity Ratio

$$= \frac{5h(\text{Room Length} + \text{Room Width})}{(\text{Room Length}) \times (\text{Room Width})}$$

where

 $h = h_{RC}$ for the Room Cavity Ratio, RCR

 $= h_{CC}$ for the Ceiling Cavity Ratio, CCR

 $= h_{FC}$ for the Floor Cavity Ratio, FCR Note that

$$CCR = RCR \frac{h_{CC}}{h_{RC}}$$

and

$$FCR = RCR \frac{h_{FC}}{h_{RC}}$$

Cavity Ratios may also be obtained from Fig. 9-38.

The illuminance in rooms of irregular shape

can be determined by calculating the Room Cavity Ratio using the following formula and solving the problem in the usual manner:

Cavity Ratio =
$$\frac{2.5 \times (\text{Cavity Height})}{(\text{Area of Cavity Base})}$$

Effective Cavity Reflectances. Fig. 9-39 provides a means of converting the combination of wall and ceiling or wall and floor reflectances into a single Effective Ceiling Cavity Reflectance, ρ_{CC} , and a single Effective Floor Cavity Reflectance, ρ_{FC} . In calculations, ceiling, wall and floor reflectances should be initial values. The RSDD factor (see page 9-9) compensates for the decrease of reflectance with time. Note that for surface-mounted and recessed luminaires, CCR = 0 and the ceiling reflectance may be used as ρ_{CC} .

A rectangular cavity consists of four walls, each having a reflectance of ρ_W , and a base of reflectance ρ_B (ceiling or floor). The effective reflectance, $\rho_{\rm eff}$, of this cavity is the ratio of flux reflected out, divided by the flux entering the cavity through its opening. If the reflectances are assumed to be perfectly diffuse and the flux is assumed to enter the cavity in a perfectly diffuse way, it is possible to calculate the effective cavity reflectance using flux transfer theory (see page 9-3). The result is:

$$\rho_{\text{eff}} = \frac{\rho_{\text{B}}\rho_{\text{W}}f\left[\frac{2A_{\text{B}}}{A_{\text{W}}}(1-f) - f\right] + \rho_{\text{B}}f^{2} + \rho_{\text{W}}\frac{A_{\text{B}}}{A_{\text{W}}}(1-f)^{2}}{1 - \rho_{\text{B}}\rho_{\text{W}}\frac{A_{\text{B}}}{A_{\text{W}}}(1-f)^{2} - \rho_{\text{W}}\left[1 - 2\frac{A_{\text{B}}}{A_{\text{W}}}(1-f)\right]}$$

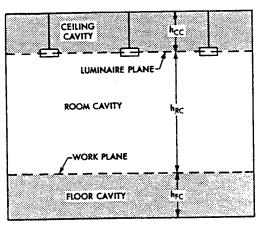


Fig. 9-37. Cavities used in the Zonal-Cavity Method.

Fig. 9-36. Average Illuminance Calculation Sheet

GENERAL INFORMATION

Project identification:	
(Give r	name of area and/or building and room number)
Average maintained illuminance for design: lux or footcandles	Lamp data: Type and color:
Luminaire data:	Number per luminaire:
Manufacturer:	Total lumens per luminaire:
Catalog number:	Total lumens per luminaire.
	COURT OF LITTERATION
	FICIENT OF UTILIZATION
Step 1: Fill in sketch at right.	to=_% to=
Step 2: Determine Cavity Ratios from Fig. 9–38, or by formulas.	
Doom Coulty Datio DCD -	W
Room Cavity Ratio, RCR =	WORK-PLANE
Ceiling Cavity Ratio, CCR =	- P=% _P=% hec =
Floor Cavity Ratio, FCR =	
Step 3: Obtain Effective Ceiling Cavity Reflectance ($\rho_{\rm cc}$) from Fig. 9–39. $\rho_{\rm CC} =$
Step 4: Obtain Effective Floor Cavity Reflectance (ρ_{FC})	from Fig. 9–39. $\rho_{FC} = $
Step 5: Obtain Coefficient of Utilization (CU) from Ma	nufacturer's Data. CU =
SELECTION OF LI	GHT LOSS FACTORS
Nonrecoverable Luminaire ambient temperature (See page 9–5.) Voltage to luminaire (See page 9–5.) Ballast factor (See page 9–5.) Luminaire surface depreciation (See page 9–7.)	Recoverable Room surface dirt depreciation RSDD (See page 9–9.) Lamp lumen depreciation LLD (See page 9–8.) Lamp burnouts factor LBO (See page 9–9.) Luminaire dirt depreciation LDD (See page 9–8.)
Total light loss factor, LLF (product	t of individual factors above) =
CALCI	JLATIONS
(Average Main	tained Illuminance)
(Illuminance) × (Are	ea)
Number of Luminaires = $\frac{\text{(Illuminance)} \times \text{(Arc}}{\text{(Lumens per Luminaire)} \times \text{(Continuity)}}$	V) × (LLF)
_	<u> </u>
Illuminance = (Number of Luminaires) × (L	umens per Luminaire) × (CU) × (LLF) (Area)
	=
Calculated by:	Date:

Fig. 9-62. Continued (see page 9-53 for instructions and notes)

	Typical Intensit Distribution an			80			70			50			30			10		0		PCC -
Typical Luminaire	Per Cent Lamp Lumens	ρ _W →	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0	WDRC	PW -
	Maint. so	RCR	= 1 = 1 = 1 = 0 = 4 = 0 = 4 = 0 = 1 = 10								RCF									
25	Cat.	1	.99	.99	.99	.94	.94	.94	.85	.85	.85	.77	.77	.77	.69	.69	.69	.65		
55-	L	1 2	.87 .77	.84 .71	.81 .67	.83 .73	.80 .68	.77 .64	.75 .67	.73 .63	.71 .60	.68 .60	.66 .58	.65 .55	.62 .55	.60 .53	.59 .51	.56 .48	.236 .220	1 2
Colonial Col	22 1/2 4	3 4	.68	.62 .54	.56 .48	.65 .58	.59 .52	.54 .47	.59 .53	.55 .48	.51 .44	.54 .48	.50 .44	.47 .41	.49 .44	.46 .41	.44 .38	.41 .35	.203 .186	3
		5	.54	.47 .42	.42	.52 .47	.46	.41 .36	.48 .43	.42 .38	.38 .34	.44	.39 .35	.36 .32	.40 .36	.36 .33	.33 .30	.31 .27	.170 .157	5 6
	65% ()	7	.45	.37	.32	.43	.36	.32	.39	.34	.30 .27	.36 .33	.32	.28 .25	.33 .31	.29 .27	.26 .24	.24 .22	.145 .135	1 8
Porcelain-enameled reflector with		8 9	.41	.34	.29 .26	.39	.33	28 25 23	.36 .33 .31	.28 .25	.24 .22	.31 .28	.26 .24	23 21	.28 .26	24 22	22	.20	.126	10
_35°CW shielding 26	II 1.5/	10	.95	.95	.95	.33	<i>.27</i> .91	.91	.83	.83	.83	.76	.76	.76	.69	.69	.69	.66		\vdash
	L	1 2	.85 .75	.82 .71	.79 .67	.81 .72	.79 .68	.76 .65	.75 .67	.73 .63	.71 .61	.69 .62	.67 .59	.66 57	.63 .57	.62 .55	.61 .53	.58 .51	.197 .194	1 2
(S)	1721	_ 3 4	.67 .60	.61 .54	.57 .49	.65 .58	.59 .52	.55 .48	.60 .54	.56 .49	.52 .45	.55 .50	.52 .46	.49	.51 .46	.49 .43	.46 .41	.44 .39	.184 .173	
		5	.54	.47	.43	.52	.46	.42	.49	.43	.40 .35	.45 .41	.41 .37	.38	.42 .38	.39 .35	.36 .32	.34 .30	.162 .151	:
>	6621	\1 6 7	.49	.42 .38	.37	.47 .43	.37	.32	.40	.35	.31	.38	.33	.30 .27	.35 .32	.31 .28	28 26	.27 .24	.141	
Diffuse aluminum reflector with			.40 .37	.34	.29 .26	.39 .36	.33	.29 .26	.37 .34	.31 .29	.28 .25	.34	.30 .27 .25	.24 .22	.30	26 24	.23	21 .19	.124	1
35°CW shielding	l 1.	0 0	.91	.28 .91	.91	.86	.27	.23 .86	.77	.77	.77	.29 .68	.68	.68	.61	.61	.61	.13		Γ,
	1	1 2	.80 .71	.77 .67	.75 .63	.76 .68	.74 .64	.71 .60	.69 .61	.67 .58	.65 .55	.62 .55	.60 .53	.59 .51	.55 .50	.54 .48	.53 .46	.50 .43	.182	
A PARA	231/24	_ 3	.63 .57	.58 .51	.53 .46	.60 .54	.55 .49	.51 .44	.55 .49	.51 .45	.47 .41	.50 .45	.46 .41	.44 .38	.45 .41	.42 .38	.40 .35	.38	.163 .151	
All the second		5	.51	.45	.40	.49	.43 .38	.39	.45	.40	.36 .32	.41 .37	.37	.34	.37 .34	.34	.31 .28	.29 .26	.140	
	572+	6 7	.46	.40 .36	.35 .31	.44	.35	.30	.37	.32 .29	29 26	.34	.30 .27	27 24	.31 .29	.28 .25	.25 .23	23 21	.121	
Porcelain-enameled reflector with	lΥ	9	.38 .35 .33	.32 .29 .27	.28 .25 .23	.37 .34 .31	.31 .28 .26	.27 .25 .22	.34 .31 .29	27 24	.23 .21	29	25 23	.22	.27 .25	.23 .21	.21 .19	.19	.106	,
30°CW × 30°LW shielding 28	H 1.5/		.83	.83	.83	.79	.79	.79	.72	.72	.72	.65	.65	.65	.59	.59	.59	.56	100	
a Pa		1 2	.74 .66	.72 .62	.70 .59	.71 .64	.69 .60	.67 .57	.65 .58	.63 .56	.62 .53	.59 .54	.58 .51	.57 .49	.54 .49	.53 .47	.52 .46	1	.160 .158	
	1724	-\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	.59 .53	.54 .48	.50 .44	.57 .51	.53 .46	.49 .42	.53 .47	.49 .43	.46 .40	.48 .44	.46 .41	.43 .38	.45 .40	.42 .38	.40 .36	.34	.150	
		5	.48	.42 .38	.38 .34	.46 .42	.41 .37	.37 .33	.43	.39 .35	.35 .31	.40 .36	.36 .33	.33 .30	.37	.34 .31	.32 .28		.132	
	56321	7 8	.40 .36	.34 .31	.30 .27	.38	.33 .30	.29 .26	.36 .33	.31 .28	.28 .25	.33	.30 .27	.27 .24	31 29	.28 .25	.25 .23		.116	
Diffuse aluminum reflector with 35°CV × 35°LW shielding	4 · K	و 10	.33	.28	.24 .22	.32	.27 .25	.24	.30	.26	.23 .21	.28 .26	.24 .22	.22 .20	26 25	.23 .21	.21 .19	.19	1	,
29	H 1.	1 0	.75	.75	.75	.69	.69	.69	.57	.57	.57	.46	.46	.46	.37	.37	.37	32		1
	1 1	1 2	.66 .59	.64 .55	.62 .52	.54		.57 .48	.51 .46		.48 .41	.38	.41		33		.32 .28	.25	.091	
	3924	3 4	.52 .47	.48 .42	.44 .38			.41 .35	.41	.38 .33	.35 .31	.34	.32 .28	.26	.27 .25		.22	.19	.079	
	1 +	— 5 6	.42 .38	.37 .33	.33 .29			.31 .27	.33		.27 .24	.28 .25	.25 .23		.23 .21	.21 .19	.20 .18			
	3224	7 8	35 32	.29	.26	.32	.2 8	.24	.28	.24	.21 .19	.23 .22	.21 .19	.19 .17	.19 .18			. 1	1	İ
Metal or dense diffusing sides wit		9	29 27	.24	.21	.27	.23		23	.20	.17	.19		.15	17	.15	.13	.12	.056	
45°CW × 45°LW shielding	N 1	.0 0				+			+-			.51	.51	.51	.48	.48	.48	.46		1
(M)	62.4	1 2				- 1			•		.46 .39	.46 .41	.45 .39	.38	.43	.37	.36	.34	.145	
	"	— 3 4	.43	.39	.36				1			.37	.35 .31		35 32					
	\	, 5	.35	.31	.28	.34	.30	.27	.32	.29	.27	.31		.26	29 27	.27	.25	.24	.111	
4	46% †) 6	29	.25	.22	. 29	.25	.22	.27	.24	.22	.28 .26	.23	.21	25	.23	.21	.20	.095	
Same as unit #29 except with top refle		/ 8				.25	.21		24	.20	.18	.24 .23	.20	.18	23 22	.19	.17	1.16	.083	
tors		10	_23	.20	.17	.23	.19	.17	.22	.19	.17	.21	.18	.16	20	.18	.16	1.15	.077	Ŀ

CHAPTER 12

ELECTRICAL CRITERIA

1. LIGHTING.

- a. Design Requirements. The design of interior, exterior, and sports lighting at Army installations will be according to the fundamentals and recommendations of the IES Lighting Handbook (reference 12-1), published by the Illuminating Engineering Society (IES), subject to the modifications and clarifications noted in subparagraphs 1.b. through 1.f., below.
- b. Lighting Intensities for Facilities. Maintained lighting intensities will conform to those recommended in the current edition of the IES Lighting Handbook, except as modified in this chapter. The IES intensities were published as minimums for specific tasks. However, the IES intensities will be considered as maximum design levels not to be changed intensities will be considered as maximum design levels not to be changed significantly except in areas designed for an integrated air-conditioning and lighting system. The recommended intensities required for the predominant specific visual tasks in an area may be provided by the general illumination for the area. However, maintained general illumination will not exceed 75 footcandles [807 lux] in any area, unless otherwise indicated in this chapter. Where fluorescent general lighting levels exceed 50 footcandles [538 lux] in air-conditioned areas, an integrated air-conditioning and lighting system will be evaluated (see chapter 13), and the lighting fixtures will meet the necessary requirements.
- (1) Conservation Requirements. Normally, general illumination levels in administrative areas will not exceed 50 footcandles [538 lux] at work stations, 30 footcandles [323 lux] in work areas, and 10 footcandles [108 lux] in nonworking areas. These illumination levels, in conjunction with energy conservation, will be obtained by the most life cycle cost-effective techniques including, but not limited to, the following:
- (a) Multiple switching of multilamp fixtures or multiple switching of fixture groups in large rooms, or both, to permit lights to be turned off at unoccupied work stations and installing two lamps in four-lamp fixtures having integral toggle switches capable of disconnecting one ballast (two lamps) from the supply source.
- (b) Time clock or photoelectric control, or both, of general indoor and outdoor lighting.
- (c) Multilevel switched ballasts to provide nonuniform general lighting.
- (d) More efficient lighting sources, fixtures, lamps, and use of solid-state ballasts.
- (e) Grid-type ceilings with the capability of interchanging relocatable panels and lighting fixtures without rewiring. This type of ceiling will provide the flexibility to accommodate changes in functional requirements of the occupants.

- (f) Lower wattage lamps (35-watt versus 40-watt fluorescent lamps).
- (2) Special Requirements. If an intensity greater than 75 footcandles [807 lux] is required for a particular task, the additional footcandles will be provided by localized (supplementary) lighting. The ratios between general and supplementary illumination will not exceed those recommended by the IES. Supplementary lighting normally will be provided by the user of the facility. However, power for such lighting will be provided by the facility.
- (3) Environmental Factors. The finish and color of surrounding surfaces, equipment, and furniture will be selected for reduced glare, increased light use, and acceptable brightness balance. Lighting equipment and layout will be coordinated with other building design features to prevent interferences and to promote a good appearance.
- (4) <u>Cross-Reference of DA Facilities to IES Tables</u>. In some instances, the names and functions of facilities used by the Department of the Army are not the same names and functions of similar facilities given in the IES Tables of Recommended Levels of Illumination, IES Lighting Handbook (reference 12-1). For the purpose of comparison, the following cross-references of types of facilities are shown in table 12-1.

TABLE 12-1

DA-IES CROSS-REFEREN	
DA Facility Designation -	IES Tables Designation -
Name or Function	Name or Function
Administrative Areas	Offices, Drafting, Conference and Accounting Rooms
Chapels	Churches and Synagogues
Classroom Buildings	Schools
Confinement Facilities	Municipal Buildings - Fire and Police
Dining Facilities	Food Service Facilities
Exchange Facilities	Stores
Parking for Military Vehicles (with minor repair areas)	Parking Areas and Service Stations

TABLE 12-1 (continued)

DA-IES CROSS-REFERENC	E OF FACILITIES
DA Facility Designation - Name or Function	IES Tables Designation -
Service Clubs	Applicable Areas of Auditoriums, Food Service Facilities, Offices, Schools, and Stores
Unaccompanied Personnel Housing	Hotels
Vehicle Maintenance Facilities	Garages and Service Stations
Warehouses	Storage Rooms or Warehouses

⁽⁵⁾ Hangar Illumination. The maintained general illumination level of hangars will not exceed 75 footcandles [807 lux].

(6) Warehouse Illumination. The general illumination level in warehouses will not exceed the values shown in table 12-2 as measured at 4 ft [1.2 m] above the finished floor.

TABLE 12-2

	Incensicy		
Types of Warehousing	Footcandles	 [Lux] 	
Active-Bulk 1	10	108	
Bin ²	5	, 1 54	
Inactive	5	54 !	
Mechanical Material Handling:		!	
Accumulation Conveyor Lines (Unmanned)	10	108	
Control Centers and Stations	30	323	

Main aisles may be lighted to 15 footcandles [161 lux].

² Specialized lighting designed to illuminate the bins, as required, will be provided by the building user.

(7) Exterior Sports Illumination. Outdoor sports lighting will conform to the classifications stated in the IES Lighting Handbook (reference 12-1), as shown in table 12-3.

TABLE 12-3

IES SPORTS CLASSIFICATIONS						
Sports Activity	IES Classification					
Baseball	Municipal and Semiprofessional					
Football	Class III or IV					
Softball	Industrial League					
Other	Recreational					

(8) <u>Illumination in Functional Areas of Other Facilities</u>. The general illumination levels in functional areas of other facilities will not exceed the intensities shown in table 12-4.

TABLE 12-4

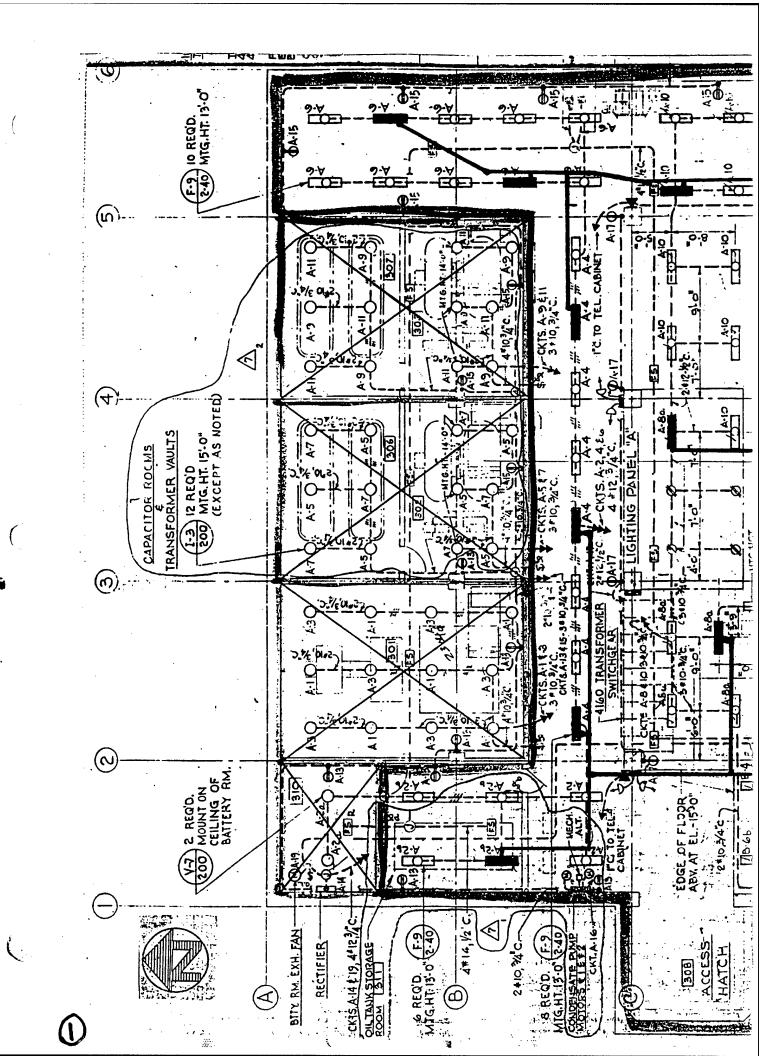
ILLUMINATION IN FUNCTIONAL	AREAS OF OTHER FACILITIES	·
	Incensi	су
Functional Areas	. Footcandles	[Lux]
Accounting Rooms	75	807
Auditoriums	20	215
Cafeterias	25	269
Computer Rooms	50	538
Conference Rooms	30	323
Corridors	10	108
Drafting Rooms	75	807
Elevator Machine Rooms	15	; 161

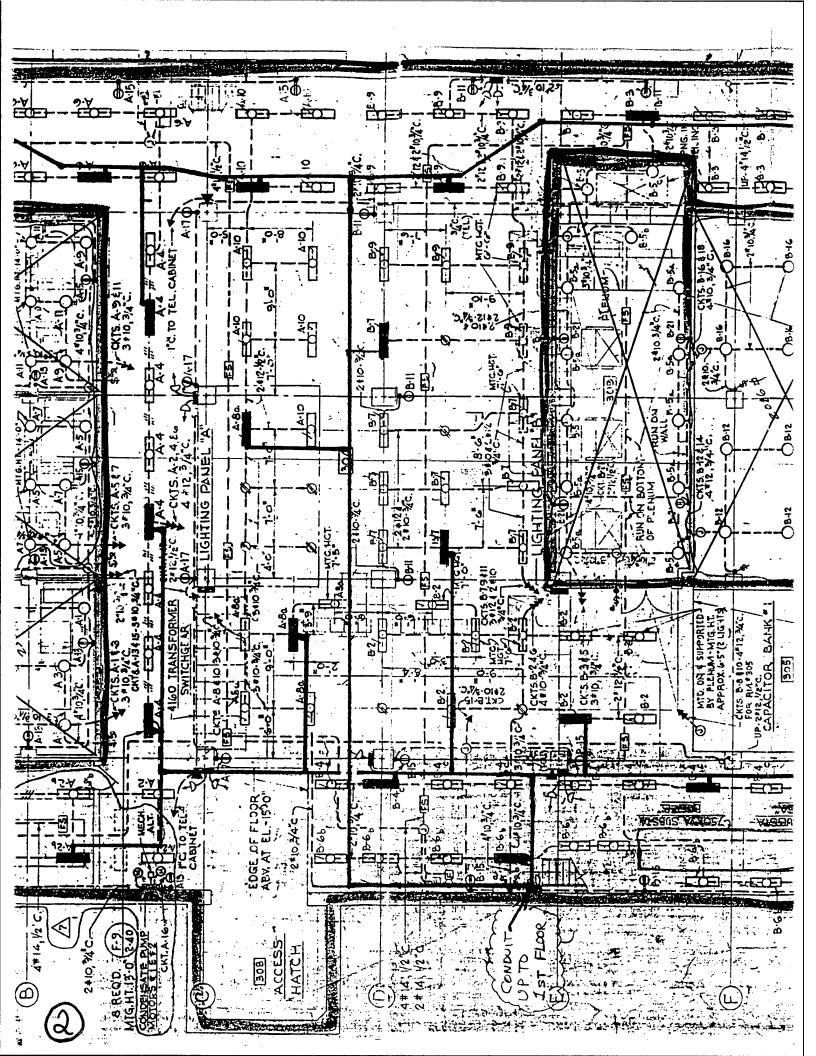
TABLE 12-4 (continued)

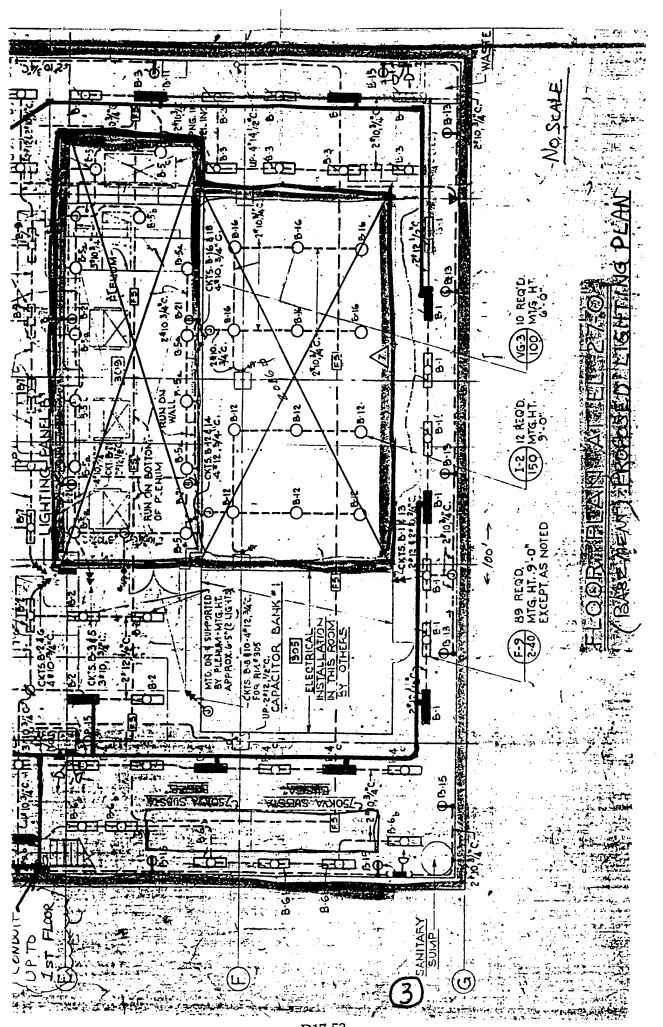
ILLUMINATION IN FUNCTIONAL AREAS OF		
************************************	Intensi	ty
Functional Areas	Footcandles	[Lux
Emergency Generator Rooms	15	1 161
Garage Driving and Parking Areas	5	54
Garage Entrances	30	323
General Office Space	50	538
Janitors' Closets	5	54
Kitchens	70	753
Lobbies	; ; 15	161
Lounges	15	161
Mechanical and Electrical Equipment Rooms) 15	161
Parking Lots	0.5	5
Stairways	20	215
Storage Rooms	. 5	, , , 54
Switchgear Rooms	15	161
Toilet Facilities	20	215
Transformer Vaults	1 15	161

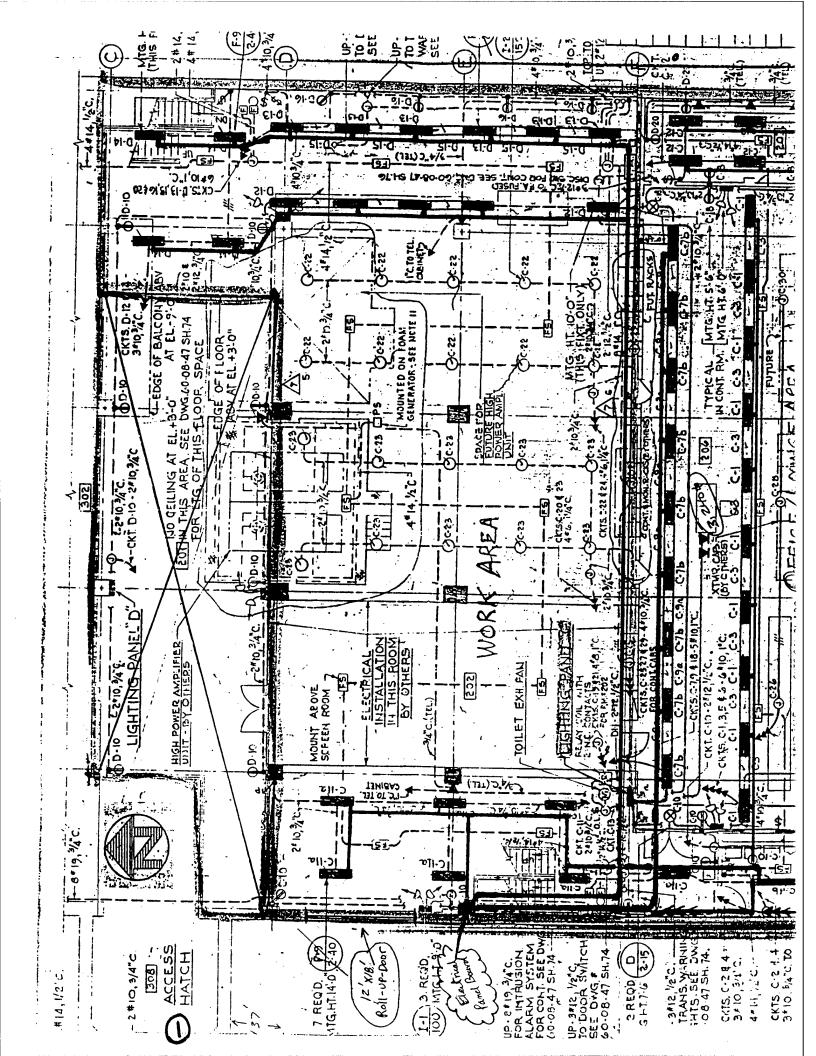
⁽⁹⁾ Special Facility Illumination. When fluorescent or high-intensity discharge lighting is prohibited and the required intensity exceeds 30 footcandles [323 lux], the general lighting system should be designed for incandescent lighting of 30 footcandles [323 lux] with supplementary incandescent lighting for specific tasks where required.

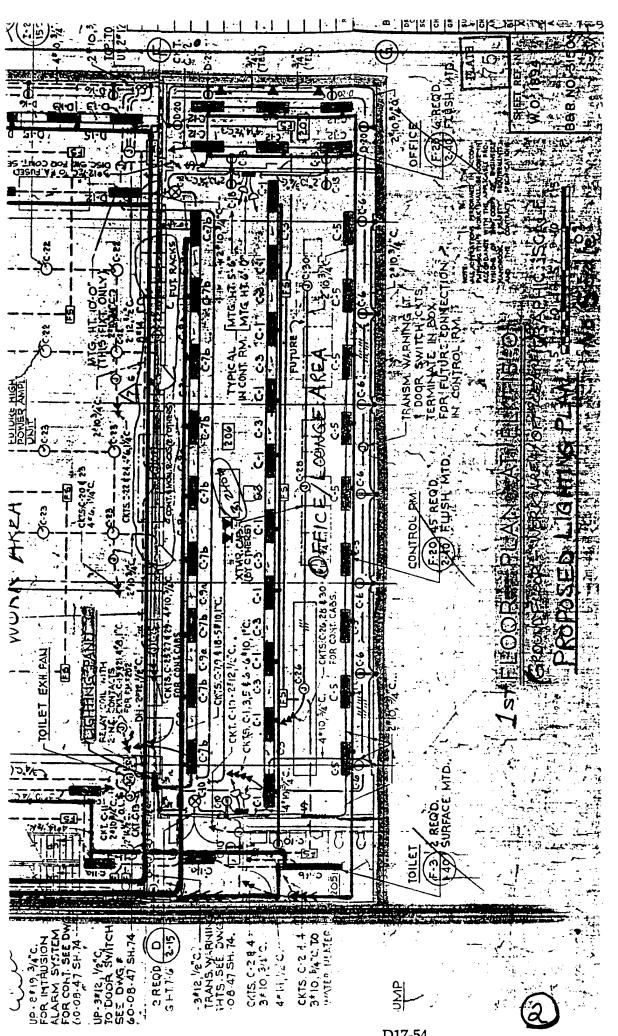
c. Emergency Lighting. Emergency lighting systems will be provided in accordance with the requirements of NFPA 101 (reference 12-2). Provisions will be made to transfer the exit lighting system to a standby generating source in facilities with standby electric power systems. Emergency supplementary incandescent or fluorescent lighting of one footcandle [10.76]

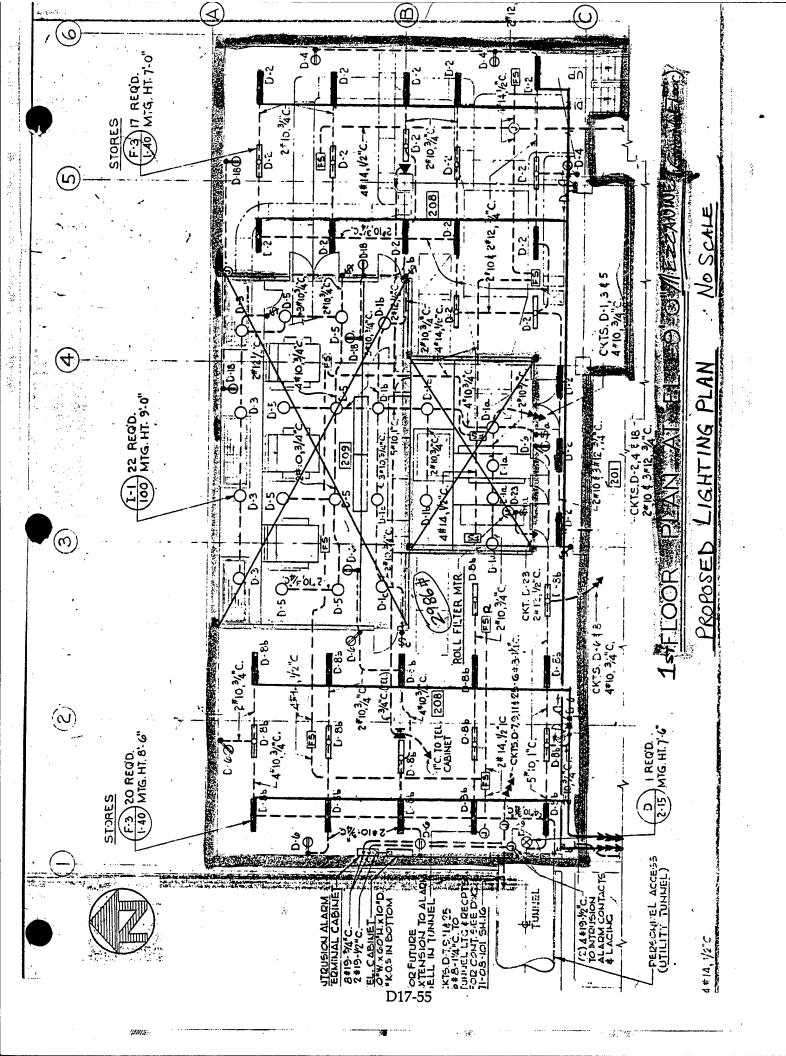


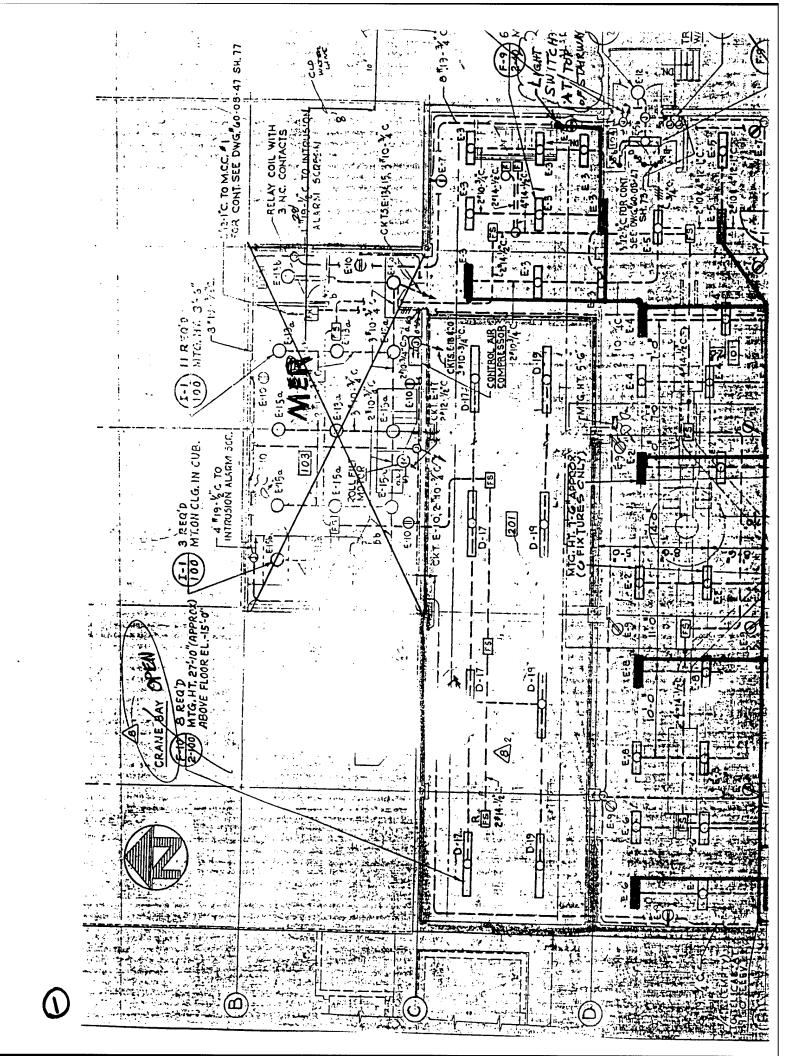


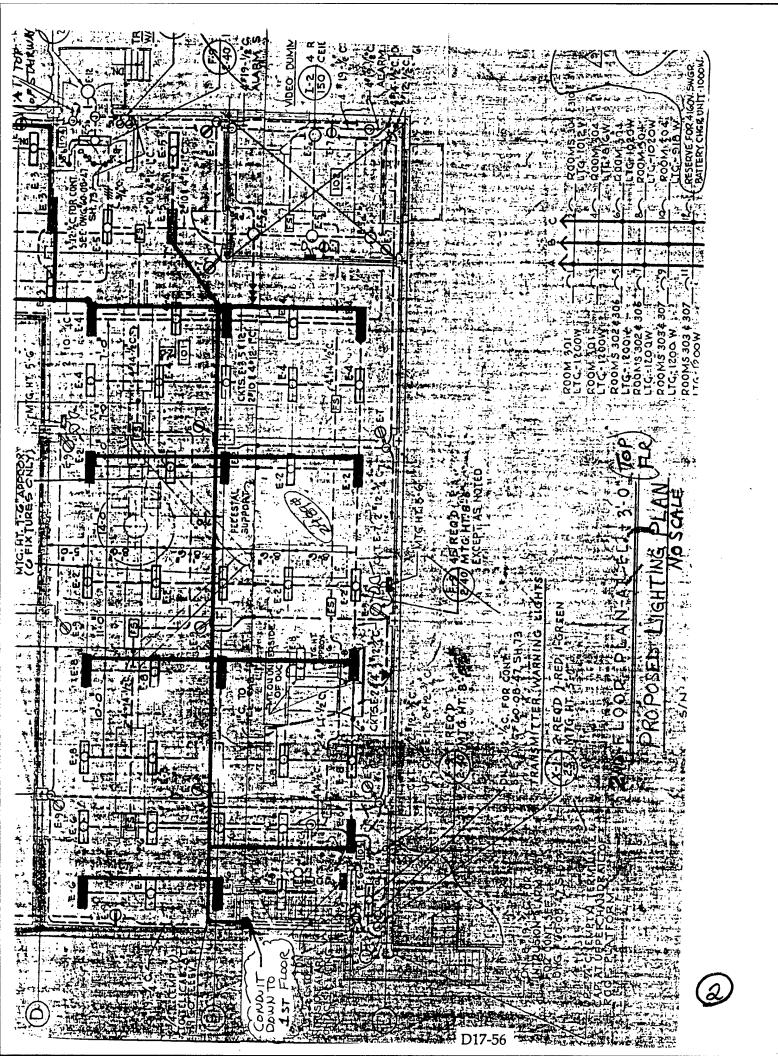












LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION: WE	A. O	la D anana	5501011			
		LOCATION: Whi			REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		DISCRETE PORTI		P – MOD. CONFIG. (ECO)	BLIGHTING; SETBACK	(I-SIAI)	FISCAL YEAR:	1992
		ANALYSIS DATE:		IOTAL	ECONOMIC LIEF.	45	DDED A DED DV	A Alleranized
		ANALISIS DATE.	00/22/92		ECONOMIC LIFE:	15	PREPARED BY:	A. NIEMEYER
1	INI	/ESTMENT						
		CONSTRUCTION	COST	_			\$13,355	
		SIOH COST	0001	(5.5% of 1A) =			\$13,335 \$735	
		DESIGN COST		(6.0% of 1A) =			\$801	
		ENERGY CREDIT		(1A + 1B + 1C) =			\$14,890	
		SALVAGE VALUE		(15 1 16)=			\$0	
		TOTAL INVESTME		(1D - 1E) =			>	\$14,890
				(.5 (.5)				\$14,000
2	EN	ERGY SAVINGS (+)) / COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	864	\$5,595	10.79	\$60,368	
	В.	DIST		0	\$0	11.57	\$0	
	C.	PROPANE	\$6.71	22	\$146	12.38	\$1,811	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	11.35	\$0	
	F.	TOTAL		886	5,741.1		>	\$62,179
3	NO	N-ENERGY SAVIN	IGS (+) / COST	(–)				
	A.	ANNUAL RECURF	RING (+/-) (ELE	CT. DEMAND SAVINGS)	=		\$4,310	
		1 DISCOUNT FAC	TOR		(From Table A-2) =	10.67		
		2 DISCOUNTED S	SAVINGS (+) / C	COST (-)	(3A x 3A1) =		\$45,982	
	8.	NON-RECURRING	G (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		· \$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		C.		\$0		0.00	\$0	
	_	d TOTAL		\$0			\$0	
				ITED SAVINGS (+) / COS	T (–)	(3A2 + 3Bd4) =		\$45,982
	D.	PROJECT NON-E						
		1 25% MAXIMUM				(2F5 x 0.33) =	\$20,519	
		a IF 3D1 => 3C						
		b IF 3D1 < 3C TI				(2F5 + 3D1) / 1F =	5.55	
		c IF 3D1b => 1 7		_				
		a 173010<1T	TEN PHOJECT	DOES NOT QUALIFY				
4	FIR	IST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/15)) =		\$10,051
		TAL NET DISCOUN			, , •	(2F5 + 3C) =		\$108,161
				TMENT RATIO (SIR)		(5/1F) =		7.26
		SIR < 1 THEN PRO		• •		() –		7.25
7		MPLE PAYBACK (SF		•		(1F/4) =		1.48
		•	-			,, –		1.70

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION: White	a Sanda Missil	a Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				- SETBACK/SETUP TH		•	FISCAL YEAR:	1992
		DISCRETE PORTIC		TOTAL	Elimootat (moo: oo	· · · · · · · · · · · · · · · · · · ·	TOOTE TENT.	1002
		ANALYSIS DATE:	06/18/92		ECONOMIC LIFE:	15	PREPARED BY:	A. NIEMEYER
1 1	iN۱	/ESTMENT						
	A.	CONSTRUCTION	COST	=			\$2,016	
E	В.	SIOH COST		(5.5% of 1A) =			\$111	
(C.	DESIGN COST		(6.0% of 1A) =			\$121	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$2,248	
	E.	SALVAGE VALUE		=			\$0	
ı	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$2,248
2 1	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
		ELEC	\$6.48	129	\$834	10.79	\$8,996	
		DIST		0	\$0	11.57	\$0	
		PROPANE	\$ 6.71	356	\$2,389	12.38	\$29,581	
		PAPER		0	\$0		\$0	
		COAL			\$0	11.35	\$0	
,	۲.	TOTAL.		485	3,223.1		>	\$38,577
2 1	NO	N-ENERGY SAVING	SS / W / COST /					
				(=) CT. DEMAND SAVINGS)	_		(\$683)	
•	٦.	1 DISCOUNT FAC		DI. DEMAND SAVINGS	(From Table A-2) =	10.67	(\$003)	
		2 DISCOUNTED S		OST (=)	$(3A \times 3A1) =$	10.07	(\$7,282)	
E	В.	NON-RECURRING		,	(5/1/2 5/11) =		(47,202)	
		ITEM	,		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0	.,	0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
(C.	TOTAL NON-ENER	RGY DISCOUN	ITED SAVINGS (+) / COS	FT (-)	(3A2 + 3Bd4) =		(\$7,282)
ī	D.	PROJECT NON-EN	NERGY TEST					
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$12,730	
		a IF 3D1 => 3C T	HEN GO TO 4					
		b IF 3D1 < 3C TH		TE SIR		(2F5 ÷ 3D1) / 1F =		
		c IF 3D1b => 1 T		•				
		d IF 3D1b < 1 TH	EN PROJECT	DOES NOT QUALIFY				
		ot vern						
		IST YEAR DOLLAR			, (2F3	+ 3A + (3B1d/15)) =		\$2,541
		TAL NET DISCOUN				(2F5 + 3C) =		\$31,295
		COUNTED SAVING		` *		(5/1F) =		13.92
		PLE PAYBACK (SP		OT QUALIFT)		/4 <i>E/A</i> \ =		0.00
, ;	۱۱۷د	LL FATBAUK (SPI	٥,			(1F/4) =		0.88

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION: Whit	a Sande Miceil	e Banga	REGION:	4	DDO IEST NO	
				RGY EFFICIENT LIGHTI	,	4	PROJECT NO: FISCAL YEAR:	DACA 63-91-C-0152
		DISCRETE PORTIC		TOTAL	114 (MOD: OOM 14.)		FISCAL TEAH.	1992
		ANALYSIS DATE:	06/17/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
								A. 0101211
1	IN۱	/ESTMENT						
	A.	CONSTRUCTION	COST	=			\$11,338	
	B.	SIOH COST		(5.5% of 1A) =			\$624	
	C.	DESIGN COST		(6.0% of 1A) =			\$680	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$12,642	
		SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D – 1E) =			>	\$12,642
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	674	\$4,365	15,23	\$66,480	
	В.	DIST		0	\$0	17.28	\$0	
	C.	PROPANE	\$6.71	(148)	(\$990)	19.64	(\$19,438)	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		527	3,375.3		>	\$47,042
,	NO	N_ENEDOV CANAL	SC (A) (COOT (
3		N-ENERGY SAVING		-) C. DEMAND SAVINGS)				
	۸.	1 DISCOUNT FACT		J. DEMAND SAVINGS)	/Erom Toble A O	44.00	\$4,290	
		2 DISCOUNTED SA		OST (L)	(From Table A-2) =	14.68	400.0	
	В.	NON-RECURRING		OO! (-)	(3A x 3A1) =		\$62,977	
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$0			\$0	
				TED SAVINGS (+) / COS	T (–)	(3A2 + 3Bd4) =		\$62,977
		PROJECT NON-EN						
		1 25% MAXIMUM N		CALCULATION		(2F5 x 0.33) =	\$15,524	
		a IF 3D1 => 3C T						•
		b IF 3D1 < 3C TH		TE SIR		(2F5 + 3D1) / 1F =	4.95	
		c IF 3D1b => 1 Th		3050 1107 01111				
		u ir 3∪10 < 1 (M	EN PHOJECT	DOES NOT QUALIFY				
4	FIR	ST YEAR DOLLAR S	SAVINGS (+) / C	COSTS (-)	(2F3 -	+ 3A + (3B1d/25)) =		\$7,665
		TAL NET DISCOUNT			•	(2F5 + 3C) =		\$110,019
6	DIS	COUNTED SAVING	S-TO-INVEST	MENT RATIO (SIR)		(5/1F) =		8.70
	(IF	SIR < 1 THEN PRO	JECT DOES N	OT QUALIFY)		-		
7	SIM	PLE PAYBACK (SPE	3)			(1F/4) =		1.65

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NWC							
CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SOU	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	ORTH BLVE)., #C-200,	DENVER, CO) 80227	
CONTRACT F	CONTRACT FOR (Work to be performed) ECO'S FOR MODIFIED CONFIGURATION – BLDG, 24072	BLDG. 240	072				PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE R	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WHITE SAN	DS MISSILE	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	cost		LABOR COSTS			
Line	ltem	og Eg	Quantity			Manhours	Average		Other Direct	Line
Š.	(1)	Measure (2)	ග	<u>F</u> €	Total (5)	Mandays (6)	Rate (7)	Total (8)	Costs (9)	Totai (10)
-	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS			·						
	4 FT. ENERGY EFFICIENT LAMPS	EA	234	2.19	512.46	0.09	27.60	568.34		\$1,080.80
	ENERGY EFFICIENT BALLASTS	EA	117	14.06	1645.02	0.85	27.60	2748.05		\$4,393.07
]	LIGHTING BRANCH CIRCUITS	LF	1988	1.06	2104.74	0.07	27.60	3588.97		\$5,693.71
D1 7 -(LIGHTING SWITCHES	EA	12	90.9	72.72	0:30	27.60	98.04		\$170.76
50	LIGHTING PANEL BOARD	EA	-	317.2	317.20	7.00	27.60	193.20		\$510.40
	TOTAL									\$11,338.33
8	MODIFY CONTROLS - INSTALL SETBACK/SETUP THERMOSTAT									
	SETBACK/SETUP THERMOSTAT	EA	-	108.6	108.6	1.00	27.63	27.63		\$136.26
	2" CONTROL VALVE - STEAM	EA	-	494.0	494.0	2.00	35.81	71.62		\$565.62
	3" CONTROL VALVE - CHILLED WATER	EA	-	1056.0	1056.0	4.00	35.81	143.24		\$1,199.24
	PRESSURE/ELECTRIC SWITCH	EA	-	87.5	87.5	1.00	27.63	27.63		\$115.13
	TOTAL									\$2,016.25
	TOTAL FOR MODIFIED CONFIGURATION									\$13,354.58
	Source: Lightbulb Supply Co., Denver, CO; Means Electrical & Mechanical Cost Data, 1992; Material prices include 25% overhead & profit, Labor source: U.S. Dept. of Labor, General Wage Decision No. NM91-1 (Overhead & Profit included);	I Cost Data, 1992;	Material prices in	Iclude 25% overh	ead & profit, Labor so	wroe: U.S. Dept. of	Labor, General Wag	e Decision No. NM9	1-1 (Overhead & Prof	t included);



ESOS STUDY AT WSMR - BUILDING 24072
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
ALT 1 - MODIFIED BSLN, ALTS 2,3 - SYNG (MODIFIED BASELINE)

Weather File Code: ELPASO.W

Location:
Latitude: 31.0 (deg)
Longitude: 106.0 (deg)
Time Zone: 6

Elevation: 3,918 (ft)
Barometric Pressure: 25.8 (in. Hg)

Summer Clearness Number: 1.00

Summer Clearness Number: 1.00
Winter Clearness Number: 1.00
Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

rangagija

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 21:38: 2 6/16/92

Dataset Name: 24072M .TM

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

Source Energy Consumption = 37,630 (Btu/Sq Ft/Year)

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	ELEC	DEMAND	CAC	CAC DAND		
			GAS	GAS DMND		
	On Peak	On Peak	On Peak	On Peak		
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)		
Jan	16,039	38	1,979	11		
Feb	14,146	38	1,560	11		
March	16,255	38	689	9		
April	12,884	35	. 0	4		
May	16,583	48	0	0		
June	20,470	56	0	0	Emonthly K	14/ 22
July	22,596	56	0	0	Zmoning L	"= 5 LL
Aug	21,054	56	0	0		
Sept	15,842	50	0	0		
0ct	13,478	31	0	0		
Nov	14,719	38	750	9		
Dec	15,458	38	1,394	10		
Total	199,524	56	6,372	11		
Building Ene	ergy Consumption	= 37,0	76 (Btu/Sq	ft/Year)	Floor Area =	35,555 (Sq Ft)

----- MONTHLY ENERGY CONSUMPTION ------

D17-62

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Trane Air Conditioning Economics

By: Trane Customer Direct Service Network
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ESOS STUDY AT USMR - BUILDING 24072
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
ALT 1 - MODIFIED BSLN, ALTS (2)3,4 - SYNG (ENERGY EFFICIENT LIGHT MG)

	9	•
Weather File Code:	ELPASO).W
Location:		
Latitude:	31.0	(deg)
Longitude:	106.0	(deg)
Time Zone:	6	
Elevation:	3,918	(ft)
Barometric Pressure:	25.8	(in. Hg)
Summer Clearness Number:	1.00	
Winter Clearness Number:	1.00	
Summer Design Dry Bulb:	98	(F)
Summer Design Wet Bulb:	64	(F)
Winter Design Dry Bulb:	24	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0653	(Lbm/cuft

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)
Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run:

8:24:58 6/18/92

Dataset Name:

24072M .TM

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

- M	0	M	T	н	L	Y	Ε	N	Ε	R	G	Υ	C	0	N	S	U	M	P	T	1	0	N	
-----	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	--

	ELEC	DEMAND	GAS	GAS DMND		
	On Peak	On Peak	On Peak	On Peak		
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)		
Jan	31,742	53	1,743	10		
Feb	28,369	53	1,313	11		
March	32,452	53	309	9		
April	28,558	47	0	2		
May	33,258	67	0	0		
June	38,222	77	0	0	_ ,	11 4. 7/27
July	41,646	80	0	0	2 mont	Aly Lw= 742
Aug	39,398	76	0	0		/
Sept	31,905	67	0	0		
Oct	29,610	63	0	0		
Nov	30,826	53	399	9		
Dec	31,061	53	1,132	10		
Total	397,046	80	4,897	11		
Building Ener	gy Consumption	= 51,8	387 (Btu/Sc	Ft/Year)	Floor Area =	35,555 (Sq Ft)
Source Energy	Consumption	= 52,3	313 (Btu/So	ft/Year)		

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ESOS STUDY AT WSMR - BUILDING 24072
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
ALT 1 - MODIFIED BSLN, ALTS 23 - SYNG (SETBACK-SETUP T-STAT / MODIFY CONTROLS)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 3,918 (ft) Elevation: Barometric Pressure: 25.8 (in. Hg) Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 98 (F) Summer Design Dry Bulb: Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20 Air Density: 0.0653 (Lbm/cuft) Air Specific Heat: 0.2444 (Btu/lbm/F) Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run:

23:10:43 6/16/92

3.9171 (Lb-min./hr/cuft)

Dataset Name:

Enthalpy Factor:

Hanne S

24072M .TM

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3

Building Energy Consumption =

Source Energy Consumption =

.compromosé

	ELEC	DEMAND	GAS	GAS DMND			
	On Peak	On Peak	On Peak	On Peak			
Month	(kWh _i)	(kW)	(Therm)	(Thrm/hr)			
Jan	17,904	38	3,206	7			
Feb	16,251	38	2,455	6			
March	18,837	38	908	3ril	12,884	35	0
May	21,316	48	0	0			
June	25,530	56	0	0			
July	28,325	57	0	0			
Aug	26,228	56	0	0			
Sept	20,258	49	0	0			
Oct	13,477	31	0	0			
Nov	17,992	38	1,031	4			
Dec	18,249	38	2,333	5			
Total	237,250	57	9,933	7			

35,555 (Sq Ft)

Floor Area =

------ MONTHLY ENERGY CONSUMPTION -----

Emmthly KW= 487

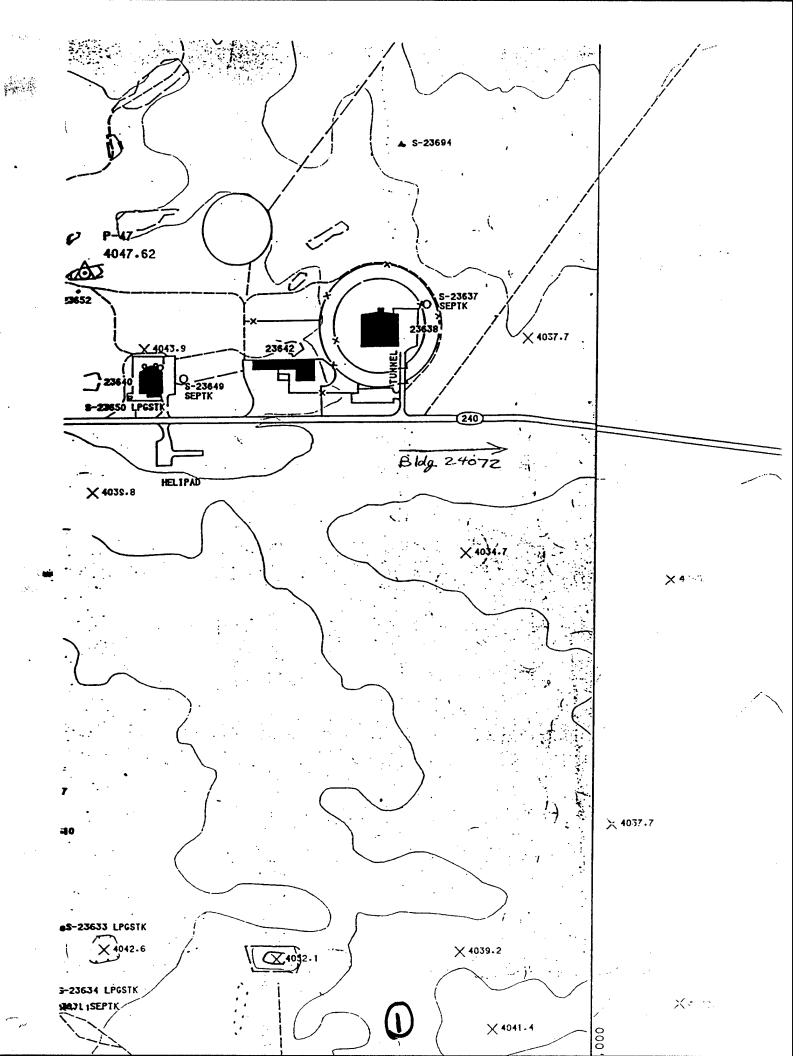
50,712 (Btu/Sq Ft/Year) 51,576 (Btu/Sq Ft/Year)

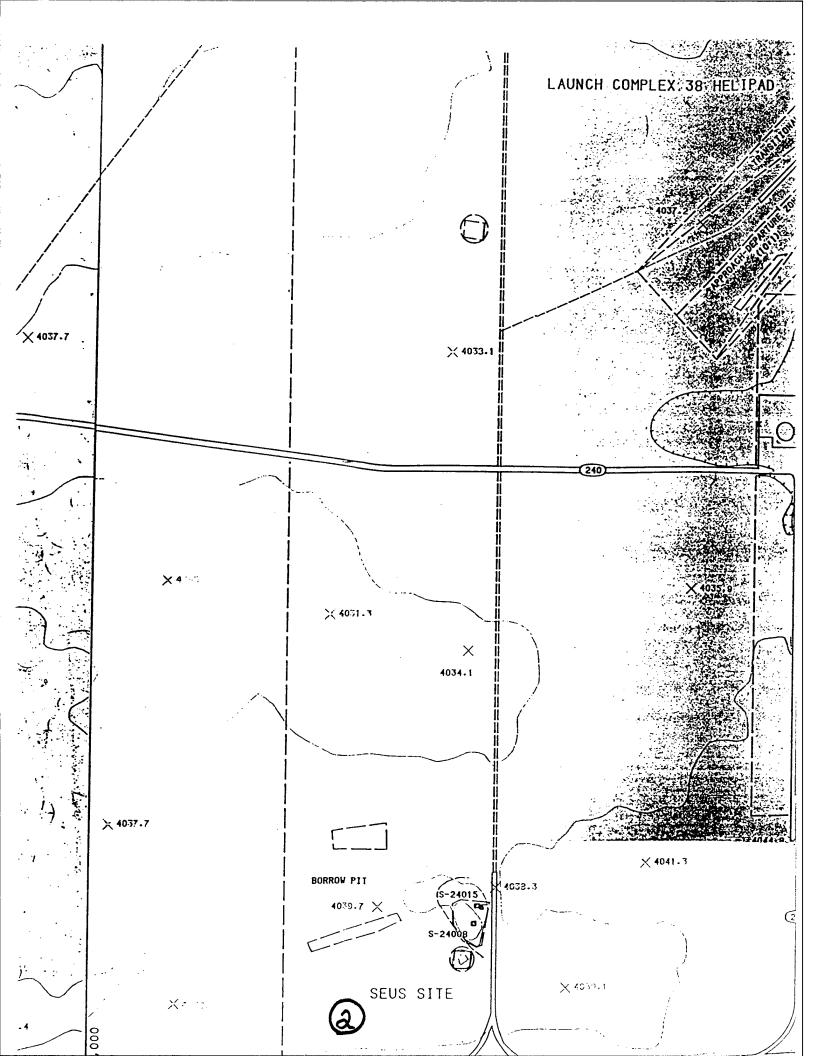
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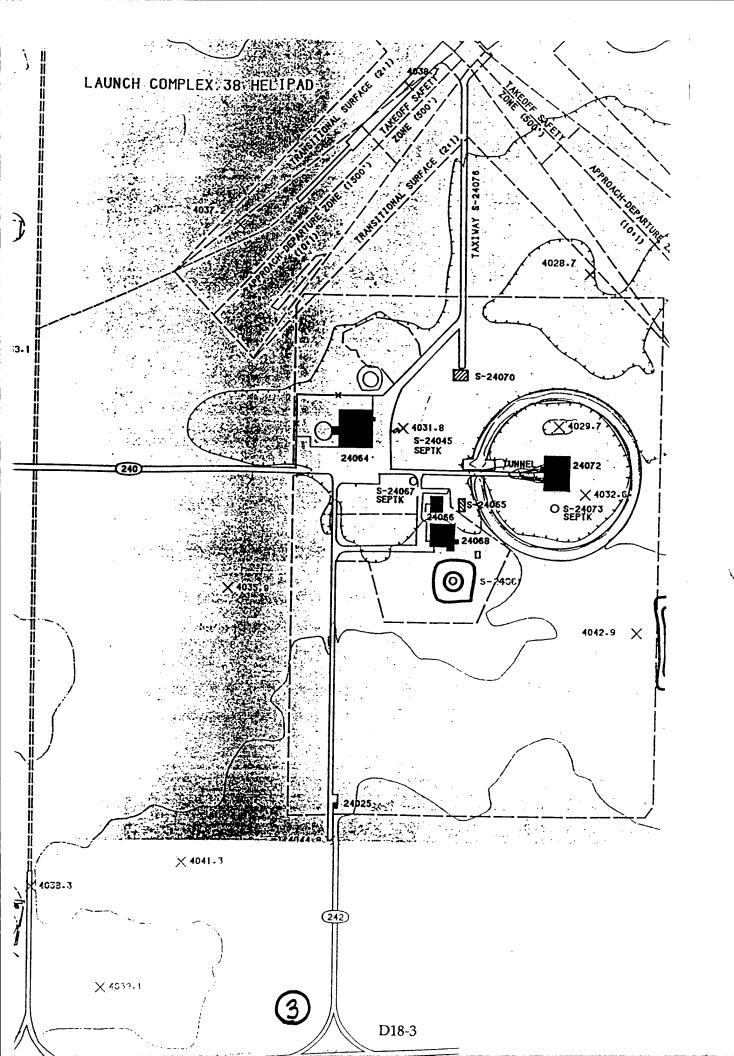
Baseline TRACE Utility Summary Reports

Recurring and Nonrecurring Maintenance Costs for Baseline and the Four Alternatives

- ALT 1A Air-Cooled Chiller Serving Bldgs. 23640, 23630, 23642 and 24072
- ALT 1B Water-Cooled Chiller Serving Bldgs. 23640, 23638, 23642 and 24072
- ALT 2A Air-Cooled Chiller Serving Bldgs. 23640, 23638 and 23642 Bldg. 64072 Served by Existing Air-Cooled Chiller
- ALT 2B Air-Cooled Chiller (Same as ALT 2A, except uses a Water-Cooled Chiller)







E	M	C	EN	GIN	IEERS,	11	NC.	
	<u> </u>						_	_

Denver • Colorado Springs • Atlanta • Germany

JOB WSMILES OS STUÌ	DY #1110-000	_
SHEET NO.	OF	_
CALCULATED BY	P DATE 4/03/92	_
CHECKED BY		
SCALE		

LC38 CONSOLIDATED CHILLER PLANT STUDY.

BASE LINE DATA FOR BLDGS P23638, P23640, P23642, P24072

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

LC38 CHILLER PLANT

JOB WSNR	日ののり	DY	年1110-000
SHEET NO.		OF	1
CALCULATED BY	TF	DAŢE	4/03/92
CHECKED BY		DATE	
COALE			

ENERGY & DEMAND SUMMARY (TAKEN FROM TRACE 600 EQUIPMENT REPORTS) KWH Emonthly KWX KWHSAVINGS KWSAVINGS 3406. 23638 963,730 680.8 23640 689,253 323,1 23642 341,507 386.3 24072 438,375 111.9 TOT. BASELINE 2,432,865 1502.1 1,319,847 7,7 ALT#1A 1,113,018 1494,4 ALT# 1B 1,058,413 934.9 1,374,452 567.2 1406.0 1,164,363 96.1 4x ALT# 2A 1,268,502 811.1 1,219,294 691,0 ** ALT # 213 /, 2/3,571

* (HILLED NATER COUPLIENT ONLY WITH BODG CHU RUAF EXCLUSED.

** ALT # 24 2 28 INCLUDE THE PROPOSED PLANT PLUS DZ4072.

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

BLDG 23638 BASELINE

			•	
•—•	MONTHLY	ENERGY	C O N S U M P T I O N	

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	54,631	105	4,953	0	11
Feb	49,354	105	3,859	0	10
March	52,451	105	673	0	5
April	51,481	143	0	2	0
May	104,657	212	0	69	0
June	123,490	221	0	114	0
July	131,167	225	0	133	0
Aug	129,758	221	0	122	0
Sept	105,979	211	0	67	0
Oct	55,419	158	0	3	0
Nov	51,033	105	1,218	0	6
Dec	54,312	105	3,742	0	9
Total	963,730	225	14,445	510	11

Building Energy Consumption = Source Energy Consumption =

124,258 (Btu/Sq Ft/Year) 125,430 (Btu/Sq Ft/Year) Floor Area =

38,096 (Sq Ft)

= monthly KW FOR CHWEGUPPHENT= 680.8

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EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

													B	
			•••••			sumption			A	**	P.L		Equip	Ref
Tot	Dec	Nov	Oct	Sep	Aug	July	June	May	Apr	Mar	Feb	Jan	Code	Num
													LIGHTS	0
86,7	6979	6933	7535	6933	7813	6979	7490	7535	6933	7813	6564	7257	ELEC	•
38	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	PK	
				·									MISC LD	1
10,1	809	809	890	809	931	809	890	890	809	931	769	85 0	ELEC	
4	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	PK	
													MISC LD	2
	0	0	0	0	0	0	0	0	0	0	0	0	GAS	
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PK	
													MISC LD	3
	0	0	0	0	0	0	0	0	0	0	0	0	OIL	
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PK	
													MISC LD	4
	0	0	0	0	0	0	0	0	0	0	0	0	P STEAM	
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PK	
													MISC LD	5
	0	0	0	0	0	0	0	0	0	0	0	0	P HOTH20	
0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PK	
													MISC LD	6
	0	0	0	0 -	0	0	0	0	0	0	0	0	P CHILL	
0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PK	
									55 TONS	CTV <5	2-ST(EQ1001S	1
152,93	. 0	0	1059	21837	36183	38548	33016	21638	656	0	0	0	ELEC	
tul. 4 68.	0.0	0.0	45.4	55.8	65.3	68.4	66.0	58.1	47.4	0.0	0.0	0.0	PK	
• • /									R	ING TOWE	COOL		EQ5100	1
62,45	0	0	1138	11563	13876	13876	13428	8579	0	0	0	0	ELEC	
111,6 18.	0.0	0.0	18.6	18.6	18.6	18.6	18.6	18.6	0.0	0.0	0.0	0.0	PK	
									R	NG TOWE	COOLI		EQ5100	1
51	0	0	3	67	122	133	- 114	69	2	0	0	0	WATER	
0.	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.2	0.2	0.0	0.0	0.0	PK	
								.v.	R PUMP C	ED WATE	CHILL		EQ5001	1
53,05	0	0	910	9250	11100	11100	10742	9176	776	0	0	0	ELEC	
14.	0.0	0.0	14.9	14.9	14.9	14.9	14.9	14.9	14.9	0.0	0.0	0.0	PK	
								c.v.	TER PUMP	NSER WAT	CONDE		EQ5010	1
79,58	0	0	1365	13876	16651	16651	16114	13764	1164	0	0	0	ELEC	
	0.0	0.8	22.4	22.4	22.4	D18-8	22.4	22.4	22.4	0.0	0.0	0.0	PK	

----- EQUIPMENT ENERGY CONSUMPTION ------

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

1	ELEC	0	0	0	52	615	720	744	744	620	61	0	0		3,556
	PK	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	6	1.0
1	EQ4001		AIR	FOIL CEN	TRIF. FAI	1 C.V.									
	ELEC	42460	38351	42460	41090	42460	41090	42460	42460	41090	42460	41090	42460		499,934
	PK	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1		57.1
1	EQ2001		GAS	FIRE TU	BE HOT W	ATER									
	GAS	4953	3859	673	0	0	0	0	0	0	0	1218	3742		14,445
	PK	10.7	10.0	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	8.6		10.7
1	EQ5020		HEA.	F WATER	CIRC. PU	IP C.V.									
	ELEC	2775	2507	847	0	0	0	0	0	0	0	1167	2775		10,071
	PK	3.7	3.7	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	3.7		3.7
1	EQ5240		BOII	LER FORCE	ED DRAFT	FAN									
	ELEC	917	828	285	0	0	0	0	0	0	0	734	917		3,680
	PK	1.2	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2		1.2
1	EQ5307		BOII	LER CONTI	ROLS										
	ELEC	372	336	116	0	0	0	0	0	0	0	298	372		1,494
	PK	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5		0.5

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

------UTILITY PEAK CHECKSUMS-----

Utility ELECTRIC DEMAND

Peak Value 225.3 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num. Cooling Ed	Equipment Code Name quipment	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
1	EQ1001S	2-STG CTV <555 TONS	125.4	55.65
Sub Total			125.4	55.65
Sub Total			0.0	0.00
Air Moving	Equipment			
1		SUMMATION OF FAN ELECTRICAL DEMAND	57.1	25.33
Sub Total			57.1	25.33
Sub Total			0.0	0.00
Miscellane	eous			
Lights Base Util Misc Equi Sub Total			38.1 0.0 4.8 42.9	16.91 0.00 2.11 19.02
Grand Tota	ι		225.3	100.00

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

BLPG. 23640 BASELINE

------ MONTHLY ENERGY CONSUMPTION------

	ELEC	DEMAND	GAS		GAS DMND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(kWh)	(kW)	(Therm)	(1000 Gl)	(Thrm/hr)
Jan	55,976	107	1,318	28	2
Feb	50,346	107	982	24	1
March	55,358	110	250	. 23	0
April	54,671	113	0	27	0
May	59,801	116	0	39	0
June	60,645	118	0	46	0
July	63,781	120	0	53	0
Aug	63,876	119	0	51	0
Sept	58 , 739	115	0	39	0
Oct	56,848	111	4	26	0
Nov	53,568	107	484	24	1
Dec	55,643	107	1,060	27	1
Total	689,253	120	4,098	407	2

Building Energy Consumption = 413,692 (Btu/Sq Ft/Year)
Source Energy Consumption = 415,590 (Btu/Sq Ft/Year)

Floor Area = 6,677 (Sq Ft)

Z monthly chilled mater equipment KW= 3 23,1

PK

1 EQ5001

ELEC

PK

41 EQ5011

PK

ELEC

0.1

5550

7.5

2775

3.7

0.1

5013

7.5

2507

3.7

0.1

5550

7.5

2775

3.7

CHILLED WATER PUMP C.V.

CONDENSER WATER PUMP C.V.

0.1

5371

7.5

2686

3.7

0.1

5550

7.5

2775

3.7

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EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

				•	UIPI		ENE		CONSI					
Ref	Equip			******		K on	thly Con	eumntion						
um	Code	Jan	Feb	Mar	Apr	May	june	July	Aug	Sep	Oct	Nov	Dec	Tota
					-					·				
0	LIGHTS													
	ELEC	4573	4136	4924	4369	4749	4720	4398	4924	4369	4749	4369	4398	54,67
	PK	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.
1	MISC LD													
	ELEC	14485	13085	14592	14000	14538	14108	14431	14592	14000	14538	14000	14431	170,80
	PK	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.
2	MISC LD													
_	GAS	1318	982	250	0	0	0	0	0	0	4	484	1060	4,09
	PK	1.8	1.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.4	1.
3	MISC LD													
_	OIL	0	0	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
4	MISC LD													
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
5	MISC LD													
	P HOTH20	0	0	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
6	MISC LD													•
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1	EQ1070L		WTR-	-CLD RECI	P >30 TO	ONS								
	ELEC	6271	5435				10592	12684	12093	9143	5988	5535	6169	94,05
	PK	17.2	17.6	19.4	21.1	24.2	26.7	28.4	27.1	23.1	19.2	17.2		25815 28.
1	EQ5101		COOL	ING TOWE	:R									
	ELEC	47	50	27	 487	1180	1613	1667	1667	1613	972	49	44	9,41
	PK	0.6	0.8	0.8	2.2	2.2	2.2	2.2	2.2	2.2	2.2	0.6	0.8	19 2.
1	EQ5101		COOL	.ING TOWE	:R									•
	WATER	28	24	23	 27	39	46	53	51	39	26	24	27	40
	B 14	. -								-	~~	_~	_,	40

0.1

5371

7.5

2686

0.1

5550

7.5

2775

3.7 D18-12

0.1

5550

7.5

2775

3.7]

0.1

5371

7.5

2686

3.7

0.1

5550

7.5

2775

3.7

0.1

5371

7.5

2686

3.7

0.1

5550

7.5

2775

3.7

0.1

65,350

32,675

3.7

44,4

7.5

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

	Q530Z	CONTR	COLS											
٦	ELEC	74	67	74	72	74	72	74	74	72	74	72	74	876
	PK	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1,2 0.1
1	EQ4003		FC (CENTRIF.	FAN C.V									
	ELEC	22201	20052	22201	21485	22201	21485	22201	22201	21485	22201	21485	22201	261,398
	PK	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8
1	EQ2002		GAS	FIRE TU	BE STEAM									
	GAS	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	E95020		HEAT	T WATER	CIRC. PU	IP C.V.								
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	EQ5061		CONI	DENSATE	RETURN PI	JMP								
	ELEC	0	0	0	0	0	0	0	0	0	G	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	EQ5240		BOIL	LER FORC	ED DRAFT	FAN								
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	EQ5307		BOIL	ER CONT	ROLS									
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

------UTILITY PEAK CHECKSUMS -----

Utility ELECTRIC DEMAND

Peak Value 120.0 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	
Cooling E	quipment			
1	EQ1070L	WTR-CLD RECIP >30 TONS	41.9	34.92
Sub Total			41.9	34.92
Sub Total			0.0	0.00
Air Movin	g Equipment			
1		SUMMATION OF FAN ELECTRICAL DEMAND	29.8	24.86
Sub Total			29.8	24.86
Sub Total			0.0	0.00
Miscellan	eous			
Lights			24.0	20.00
Base Uti	lities		0.0	0.00
Misc Equ	ipment		24.3	20.21
Sub Total			48.3	40.22
Grand Tota	al		120.0	100.00

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 BLOG. 23642 BASELIAE

M O N T H L Y	ENERGY	C O N S U M P T I O N

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 GL)	GAS DMND On Peak (Thrm/hr)
Jan	28,238	85	260	0	3
Feb	24,822	80	224	0	3
March	24,340	78	38	2	2
April	23,243	90	0	7	0
May	30,378	94	0	19	0
June	33,920	99	0	27	0
July	35,824	100	0	30	0
Aug	36,333	99	0	29	0
Sept	29,643	96	0	18	0
0ct	24,715	90	0	7	0
Nov	23,321	78	60	1	2
Dec	26,730	78	162	0	2
Total	341,507	100	744	139	3

Building Energy Consumption = 131,991 (Btu/Sq Ft/Year)
Source Energy Consumption = 132,236 (Btu/Sq Ft/Year)

Floor Area =

9,394 (Sq Ft)

2 monthly kw for chilled walk squipment = 2003

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

------ EQUIPMENT ENERGY CONSUMPTION ------

							umption ·	-						Equip -	
Total		Dec	Nov	Oct	Sep	Aug	July	June	May	Apr	Mar	Feb	Jan	Code	m
														LIGHTS	0
74,72		6024	5828	6479	6024	6756	6024	6479	6479	6024	6756	5649	6202	ELEC	
24.		24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	PK	
														MISC LD	1
14,27		1151	1113	1238	1151	1291	1151	1238	1238	1151	1291	1079	1185	ELEC	
4.		4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	PK	
														MISC LD	2
		0	0	0	0	0	0	0	0	0	0	0	0	GAS	
0.		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PK	
														MISC LD	3
		0	0	0	0	0	0	0	0	0	0	0	0	OIL	
0.		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PK	
														MISC LD	
		0	0	0	0	0	0	0	0	0	0	0	0	P STEAM	
0.		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PK	
														MISC LD	
		0	0	0	0	0	0	0	0	0	0	0	0	P HOTH20	
0.		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PK	
														MISC LD	
		0	0	0	0	0	0	0	0	0	0	0	0	P CHILL	
0.		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PK	
										P >30 TO		WTR-0		EQ1070L	
34,17		0	246	1691	4542	7296	7507	6400	4524	1576.	390	0	0	ELEC	
23.	3141	18.1	18.1	18.1	20.4	23.2	23.7	22.7	18.1	18.1	18.1	18.1	18.1	PK	
								-			ING TOWE			EQ5101	
12,53		0	0	865	1809	2544	2618	2320	1746	634	0	. 0	0	ELEC	
3.	25.1	0.0	0.0	3.7	3.7	3.7	3.7	3.7	3.7	3.7	0.0	0.0	0.0	PK	
											ING TOWE			EQ5101	
13		0	1	7	18	29	30	27	19	7	2	0	0	WATER	
0.		0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	PK	
									٠٧.	R PUMP C		CHILI		EQ5001	
20,13		0	336	1394	2716	3819	3931	3483	2621	1322	515	0	0	ELEC	
5.		5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	PK	
									c.v.	TER PUMP		CONDI	•	EQ5011	
13,41		0	224	929	1809	2544	2618	2320	1746	880	343	0	0	ELEC	
3.	44,4	3.7	3.7	3.7	3.7	3.7	D1 3:7 6	3.7	3.7	3.7	3.7	3.7	3.7	PK	

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

	•										•				
) 7	ELEC	0	0	9	24	47	62	70	68	49	25	6	0	360)
	PK	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1,2 0.1	j
1	EQ4003		FC	CENTRIF.	FAN C.V.										
	ELEC	5580	5040	5580	5400	5580	5400	5580	5580	5400	5580	5400	5580	65,700)
	PK	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	j
2	EQ4003		FC	CENTRIF.	FAN C.V.										
	ELEC	5580	5040	5580	5400	5580	5400	5580	5580	5400	5580	5400	5580	65,700)
	PK	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	j
3	EQ4003		FC	CENTRIF.	FAN C.V.										
	ELEC	781	707	856	744	818	818	744	856	744	818	744	744	9,374	į
	PK	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	š
1	EQ2263		ELE	CTRIC RE	SISTANCE	HEATING									
	ELEC	4247	3406	1539	0	0	0	0	0	0	5	2121	3740	15,058	\$
	PK	6.0	6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	6.0	6.0	6.0)
2	EQ2263		ELE	CTRIC RE	SISTANCE	HEATING									
	EFEC	3095	2497	952	0	0	0	0	0	0	0	1232	2490	10,266	è
	PK	6.0	6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	6.0	6.0)
3	EQ2001		GAS	FIRE TU	BE HOT WA	TER									
	GAS	260	224	38	0	0	0	0	0	0	0	60	162	744	Þ
	PK	2.6	2.5	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	2.3	2.6	•
3	EQ5020		HEA	T WATER	CIRC. PUM	P C.V.									
	ELEC	542	475	105	0	0	0	0	0	0	0	142	394	1,659)
	PK	1.5	1.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.5	1.5	j
3	EQ5240		BOI	LER FORC	ED DRAFT	FAN									
	ELEC	804	726	332	69	0	0	0	0	0	86	414	804	3,234	,
	PK	1.1	1.1	1.1	1.1	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1	1.1	
3	EQ5307		BOI	LER CONT	ROLS										
	ELEC	223	202	92	19	0	0	0	0	0	24	115	223	898	š
	PK	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	;

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

------ UTILITY PEAK CHECKSUMS------Utility ELECTRIC DEMAND Peak Value 99.8 (kW) Yearly Time of Peak 10 (hr) 7 (mo) Hour 10 Month 7 Eqp. Utility Percnt Equipment Demand Of Tot Ref. Num. Code Name Equipment Description - (kW) (%) Cooling Equipment EQ1070L WTR-CLD RECIP >30 TONS 36.9 36.96 36.9 36.96 Sub Total Sub Total 0.0 0.00 Air Moving Equipment 1 SUMMATION OF FAN ELECTRICAL DEMAND 7.5 7.52 SUMMATION OF FAN ELECTRICAL DEMAND 7.5 7.52 2 3 SUMMATION OF FAN ELECTRICAL DEMAND 18.6 18.65 33.6 33.68 Sub Total

Miscellaneous

Sub Total

 Lights
 24.6
 24.65

 Base Utilities
 0.0
 0.00

 Misc Equipment
 4.7
 4.71

 Sub Total
 29.3
 29.36

 Grand Total
 99.8
 100.00

1

0.0

0.00

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 BLDG. 24072 BAS ELLINE

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	35,029	53	2,656	6
Feb	31,816	53	1,873	6
March	35,953	53	265	3
April	29,005	46	0	0
May	37,614	67	0	0
June	42,261	77	0	0
July	46,636	80	0	0
Aug	43,333	76	0	0
Sept	35,897	67	0	0
0ct	30,035	46	0	0
Nov	34,984	53	335	3
Dec	35,812	53	1,627	4
Total	438,375	80	6.756	6

Building Energy Consumption =

61,598 (Btu/Sq Ft/Year)

Floor Area = 35,257 (Sq Ft)

Source Energy Consumption =

62,191 (Btu/Sq Ft/Year)

Z en frall monthe= 111.9 (chilled waterspringment)

-- MONTHLY ENERGY CONSUMPTION ------

------EQUIPMENT ENERGY CONSUMPTION -----

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

Ref	Equip	*****	~~~~			Wan	thiu car	sumption						
	Code	jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
0	LIGHTS													
U	ELEC	15892	14354	15892	15379	15892	15770	15000	15900	45770	45000	45770	45000	407 441
	PK	21.4	21.4	21.4	21.4	21.4	15379 21.4	15892 21.4	15892 21.4	15379 21.4	15892 21.4	15379 21.4	15892 21.4	187,114 21.4
1	HISC LD													
•	ELEC	1223	1106	1339	1165	1281	1281	1165	1339	1165	1281	1165	1165	14,673
	PK	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
2	MISC LD													
_	GAS	9	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	MISC LD													
•	OIL	0	0	0	O	0	0	0	0	o o	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	MISC LD													
	P STEAM	0	G	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0,0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
5	HISC LD													
	P HOTHZO	0	0	0	0	0	0	0	0	0	0	0	٥	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	HISC LD													
	P CHILL	G	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	E01121L		AIR-	·CLD RECI	IP 35-60	TONS								
•	ELEC	0	0	0	0	3866	8166	11022	8246	3293	0	0	0	34,593
	PK	0.0	0.0	0.0	0.0	14.0	17.5	20.3	17.0	13.6	0.0	0.0	0.0	82,4 20.3
11	E05200		COND	ENSER FA	ANS									0211
	ELEC	0	0	0	0	635	1515	1983	1387	549	0	0	0	6,069
	PK	0.0	0.0	0.0	0.0	2.2	7.9	7.9	7.9	2.1	0.0	0.0	0.0	28,0 7.9
1	EQ5001		CHIL	LED WATE	ER PUMP (c.v.								
	ELEC	0	0	0.	0	2544	2686	2775	2775	2574	0	0	C	13,353
	PK	0.0	0.0	0.0	0.0	3.7	3.7	3.7	3.7	3.7	0.0	0.0	0.0	3.7
→ 1	EQ5313		CONT	rols										
	ELEC	0	0	0	0	205	216	223	223	207	0	0	0	1,074
	PK	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	1,5
2	EQ1288S				HEAT PUMP	2 <11 TO	ıs							
	ELEC	3219	3077	3997	1523	1860	2033	2213	2116	1767	1561	4196	4050	31,612
	PK	4.7	4.7	4.7	4.7	3.5	3.9	4.0	3.9	3.3	2.7	4.7	4.7	4.7
							D1	8-20						

24072

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

		Conde	nser	Fan	: 5							-		·
	ELEC	115	109	144	160	194	208	225	216	186	163	134	125	1,979
	PK	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.4
2	E95306		CON.	TROLS										
	ELEC	37	34	37	36	37	36	37	37	36	37	36	37	
	PK	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	438 0.1
1	E94003		50	CENTALE	FAN C.V.									•••
•	ELEC	11100												
	PK	14.9	10025	11100	10742	11100	10742	11100	11100	10742	11100	10742	11100	130,699
	FX	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9
f	EQ2002		GAS	FIRE TU	BE STEAM									
	GAS	2656	1873	265	0	0	0	0	0	0	0	335	1627	/ 75/
	PK	6.4	5.7	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	4.1	6,756 6.4
1	EQ5020		UEAT		CIRC. PU	(0 4 1/								
	ELEC	0	0	WATER I			_							
	PK	0.0	0.0		0	0	0	0	0	0	0	0	0	0
	' "	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	EQ5240		BOIL	ER FORCE	D DRAFT	FAN								
	ELEC	1406	1270	1406	0	0	C	9	0	0	0	1361	1406	4 9/0
	PK	1.9	1.9	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	1.9	6,849 1,9
1	EQ5061		רטאט	CUCATE D	RETURN PU	B40								
-	ELEC	1665	1504	1665										
	PK	2.2	2.2		0	0	0	0	0	0	0	1611	1665	8,111
	• •	6.6	2.2	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	2.2	2.2
3	EQ5307		BOIL	ER CONTR	OLS									
	ELEC	372	336	372	0	0	0	0	•	•	_			
	PK	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0	0	0	360	372	1,812
					V.0	0.0	0.0	U.U	0.0	0.0	0.0	0.5	0.5	0.5

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

Grand Total

24072

•••••		UTILITY PEAK	CHEC	K S U M S
Utility	ELECTRIC DEM	MAND		
	e 79.8 ne of Peak 1	(kW) 15 (hr) 7 (mo)		
Hour 15 I	Honth 7			
	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling E	quipment			
1 2		AIR-CLD RECIP 35-60 TONS AIR TO AIR HEAT PUMP <11 TONS		40.37 5.60
Sub Total			36.7	45.97
Sub Total			0.0	0.00
Air Movin	g Equipment			
1		SUMMATION OF FAN ELECTRICAL DEMAND	14.9	18.69
Sub Total			14.9	18.69
Sub Total			0.0	0.00
Miscellan	eous			
Lights			21.4	26.76
Base Uti	lities		0.0	0.00
Misc Equ	i pment		6.9	8.58
Sub Total			28.2	35.34

79.8 100.00

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

LC38 EQUIPMENT COST SUMM ANY

JOB WS A	ur esos study	#1110 -000
SHEET NO.		2 _{of} _ 2
CALCULATED BY	A NIEWEYER	_ DATE 4/01/92
CHECKED BY	TF	_ DATE 4/01/92
SCALE		

1	RECURPING	NON RECU	arring costs
	COST (A/YR)	YEAR OF REPLACEMENT	REPLACEMENT MAINT
BASEUNE	9,709	1	283,750. 8,512
	,	5	39,900 1,197
ALT#IA		-1	533,942 16,018
ALT#18		ľ	559,565 14,787
AT # 2A		I	261,796 7,854
AT#28		١	297,706 8,931

DIFFERENTIAL COSTS

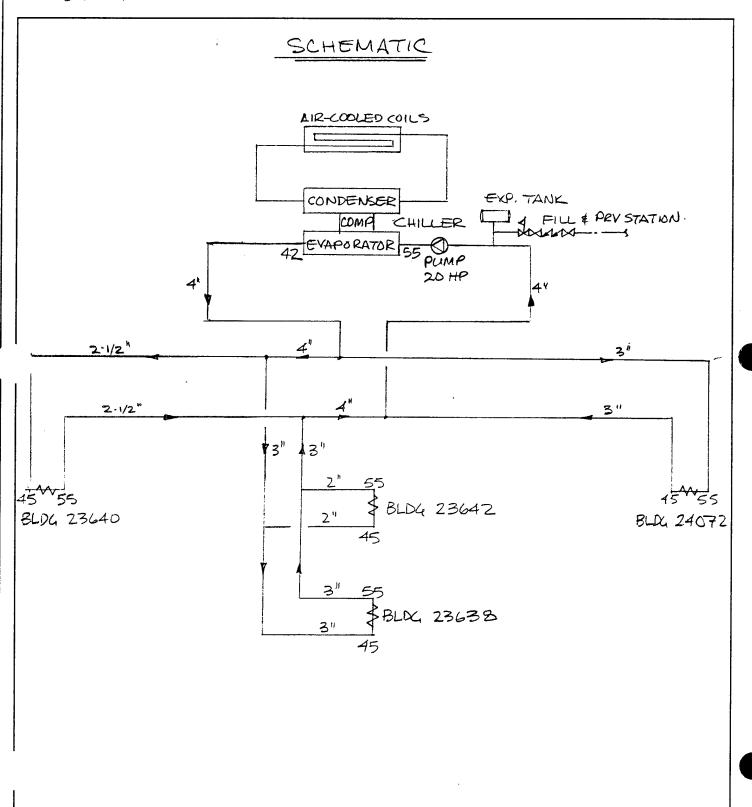
	COSTS. (*)	Year	# #
ALT#IA	-C, 309	5	+283,750
ALT # 1B	-7,078	5	+ 283,750
ALT # 2A	648	1	+283,750
A LT # 28	_ 419	15	+283,750

E M C ENGINEERS, INC.

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LAUNCH COMPLEX #38 ALT. # | A

JOB WSMR	ESUS STUDY	# 1110.000
SHEET NO.		OF
CALCULATED BY	Putiez	DATE 3 · 11 · 97
CHECKED BY		DATE



D18-24

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION: Wh		•	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	LAUNCH COM	IPLEX 38 - CHILLER PI	_ANT STUDY - ALT. 1	A	FISCAL YEAR:	1992
		DISCRETE PORT	ION NAME:	TOTAL				
		ANALYSIS DATE:	06/05/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IN	VESTMENT						
	A.	CONSTRUCTION	COST	=			\$533,942	
	В.	SIOH COST		(5.5% of 1A) =			\$29,367	
	C.	DESIGN COST		(6.0% of 1A) =			\$32,037	
	D.	ENERGY CREDIT	•	(1A + 1B + 1C) =			\$595,345	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTM	ENT	(1D - 1E) =			>	\$595,345
2	EN	ERGY SAVINGS (+) / COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	4,505	\$29,190	15.23	\$444,565	
	В.	DIST		0	\$0	17.28	\$0	
	C.	PROPANE	\$6.71	. 0	\$0	19.64	\$0	
	D.	PAPER	-	0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		4,505	29,190.1		>	\$444,565
3	NO	N-ENERGY SAVIN	IGS (+) / COST (-	-)				
	A.	ANNUAL RECUR	RING (+/~) (ELEC	. DEMAND SAVINGS) +	=		(\$6,159)	
		(ANNUAL RECUR	RING MAINTEN	ANCE COST)				
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	SAVINGS (+) / CC	OST (-)	(3A x 3A1) =		(\$90,412)	
	В.	NON-RECURRING	G (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. EQUIP REPLAC		\$283,750	1	0.96	\$272,400	
		b. EQUIP REPLACE	CEMENT COST	\$39,900	5	0.80	\$31,920	
		c.		\$0		0.00	\$0	
		d TOTAL		\$323,650			\$304,320	
				TED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$213,908
	D.	PROJECT NON-E						
		1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	\$146,706	
		a IF 3D1 => 3C						
		b IF 3D1 < 3C T	HEN CALCULAT	ESIR		(2F5 + 3D1) / 1F =	0.99	
		c IF 3D1b => 1 7						
		d IF 3D1b < 1 Th	HEN PROJECT D	OES NOT QUALIFY				
_								
		ST YEAR DOLLAR		OSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$35,977
		TAL NET DISCOUN				(2F5 + 3C) =		\$658,473
6		COUNTED SAVING				(5/1F) =		1.11
_		SIR < 1 THEN PRO		OT QUALIFY)				
7	SIM	IPLE PAYBACK (SF	PB)			(1F/4) =		16.55

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NW							
CONTRACTOR	A CMT CMT CMT			ADDRESS	ANO CANAL DE	1000	000			
	EMO ENGINEERS INC.			7/30 300	NADSW	ORIN BLVI	J., #C-200,	Z/30 300 In WADSWORIN BLVD., #C-200, DENVER, CO	0 80227	
CONTRACT	CONTINCT FOR (WORK to be performed) LAUNCH COMPLEX 38 (ALT 1A)						PROPOSED TOTAL	PHOPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER			WORK LOCATION	WORKLOCATION WHITE SANDS MISSIFE	BANGE NEW MEXICO	W MEXICO
				MATERIAL COST	соят		LABOR COSTS			
		Cont							Other	
Line	Item	jo	Quantity	3		Manhours	Average	F	Direct	Line
j Z	(1)	(2)	(3)	₹ €	(5)	Malidays (6)		(8)	s)(6)	(10)
	CHILLED WTR GEN, AIR-COOLED 200T (NOM), W/CONTROLS	Æ		79500.00	79500	25	35.81	2291.84		\$81,791.84
	PUMP, CENTRIF, 342 GPM, 20 HP	Æ	2	3125.00	6250	32	35.81	2292		\$8,541.84
	PIPE, INSULATED CONDUIT, 4"	Ħ	09	23.50	1410	0.72	35.81	1547		\$2,956.99
	PIPE, INSULATED CONDUIT, 3"	7	6820	18.90	128898	0.57	35.81	139208		\$268,105.79
	PIPE, INSULATED CONDUIT, 2-1/2"	7	096	16.30	15648	0.47	35.81	16157		\$31,805.47
	PIPE, INSULATED CONDUIT, 2"	느	100	16.10	1610	0.38	35.81	1361		\$2,970.78
	TRENCH & BACKFILL, 24"x36"	LUMP	3970 LF	2.81	11155.7					\$11,155.70
	PAVEMENT, REMOVE & REPLACE	LUMP SUM	400 SF	5.93	2372					\$2,372.00
	EXPANSION TANK & FILL STA.	SI	1	525.00	525	5.00	35.81	179		\$704.05
	CONCRETE PAD FOR CHILLER	LUMP SUM	7.5 CY	100.00	750					\$750.00
	PUMP HOUSING, PREFAB METAL	LUMP SUM	100 SF	30.00	3000					\$3,000.00
	VALVE, BFLY, CL 150, 4"	Æ	4	90.00	360	3.20	35.81	458		\$818.37
	INTERCONNECT @ EA BLDG.	Ē	4	2000	28000	280.00	35.81	40107		\$68,107.20
	ETHYLENE GLYCOL	GAL	900	5.9	5310	0.01	35.81	322		\$5,632.29
	SUBTOTAL OVERHEAD & PROFIT (25%)									\$488,712.33
	CONTINGENCY (10%) TOTAL THIS SHEET									\$61,089.04

ESTIMATE SUMMARY

ムトコロン 行んのS MSMR PROJECT:

30

#

COMPLEX

LAUNCH

1110-000

ALT: ESTIMATE NO. SHEET NO.

*

Butler U PREPARED BY:

DATE: 3,16.92

7850 226080 2560 5540 81100 0St 11160 630 56000 370 65°C 2490 3000 427,160 TOTAL N DATE: 23.70 3000 1 60 750 AMOUNT SUB-CONTRACT UNIT PRICE 2.81 5.93 300 300 950 92180 1280 300 200 230 1600 1080 125 320 28000 AMOUNT CHECKED BY: 25 25. 25. 25. 25. 25. 25. -52 25 25 25 57 TOTAL M.H. RATE LABOR 3887 38 5.0 1120 J 7 2,0 An Q .38 54. 4. UNIT M.H. 49 32 5.0 280 3.7 0.0 0 0 18,90 128900 005 pt 5310 6250 38.5 525 28000 <u>7</u> JNIT PRICE AMOUNT MATERIALS 3125 74 500 23,50 525 7000 <u>5</u> 5 5.90 5 3970LF 4820 LF Ø 回 90004 100 LF QUANTITY 400 SF 7.00.4 1 BSF 4 9709P 4 EA 60 LF 1.5 h <u>س</u> = ź 2-18 1.2-14.2-17.2-21 TRENCH # BACKFILL 24"x3" PAVEMENT REMOVE & REMAKE CHILLED NTR CEN. 412-COOLD PUMP CENTRIF 3426PM 20HP بآ 200 T (NOM) W/CONTROLS PLIMP HOUSING, PREFAB METAL INTERCONNECT @ EA PLK. EXPANSION TANK & FILL STA M.033-130-470/CONCRETE PAD FOR CHILLER <u>4</u> INSULATED CONDUIT, 4 150, = = LTHYLENE GLYCOL DESCRIPTION M.19.960 1060 VALVE, BFLY, = = = PR 0770 M. 151.851.073U 10720 0700 M. 157-401-1200 M. 020, 025 0100. UFP. M ACCOUNT - 15.3 1 (I ک D18-27

Denver • Colorado Springs • Atlanta • Germany
LAUNCH COMPLEX #38
ALT, 1A.

JOB WSMR ESOS STUDY	#1110,800
SHEET NO.	_ OF
CALCULATED BY C. BUTTON	DATE 3.10.92
CHECKED BY	_ DATE
SCALE	

A. FLOW RATES:

BLD4 #	DESIGN PK LOAD	× GPM/TON R.	= GPM.	
23640	36.2 TON R.	2.4	86.9	87
23642	32.3 H 11	1	77.5	78
23638	45,0 " "		108.0	108
24072	28,8 " "	4	69.1	69

B. PIPE SIZING:

GPM	PIPE SIZE	VEL, FPS	P.D. 1/100LF	LENGTH*	P.D.	CUM TOT P.D.
87	2.1/2"	5.8	5.44	960	<i>52.2</i> 2	54.68
78	211	7.5	10.88	100	10,88	10.88
108	ろ"	4.7	2.75	1220	33.55	33.55
186	る"	8.1	7.76	180	13.97	47.52
273	4"	6.9	4.10	60	2.46	49.98
69	3"	3.0	1.19	54-20	64.50	64.50

* LENGTH INCLUDES SUPPLY & RETURN PIPING (TRENCH LENGTH = 1/2 L.)

C. ESTIMATED PUMP ZHP:

+ 15' = CHILLER P.D.

50' = BLDG SYSTEM P.D.

D. PUMP MOTOR HP:

++ 1.2 ALLOWS FOR BELT DRIVE FRECTION WISSES.

Denver · Colorado Springs · Atlanta · Germany

LAUNCH COMPLEX #38

ALT. # 14

JOB WSMR FSOS STUDY	# 1110.000
SHEET NO	_ OF
CALCULATED BY C. Butler	DATE 3.11.92
CHECKED BY	DATE
SCALE	

E. CHILLER SELECTION:

CAPY REOD = 142,3 TONS. R. (FROM. A. FLOW RATES.), GPM = 342 AMBIENT TEMP = 115°F

ELEVATION = ~4000 MSL.

BRING SOLN = 30% ETHYLENE GLYCOL (BY WEIGHT); SP.GR. 21.04 ADJUSTMENT FACTORS:

FOULING FACTOR = 0.00025, ALT. ~4000': CAPY × 0,960; GPM × 0,970; KW × 1.030
30% ETHYLENE GLYCOL: CAPY × 0,975; GPM × 1.064; KW × 0.99.

 $CAPY = \frac{142.3}{0.960 \times 0.0075} = 152.0 \text{ TONS } R.$ $CPM = \frac{342}{0.970 \times 1.064} = 331.4$

USE A TRANE "RTAD 200" ROTARY COMPRESSOR, AIR-COOLED COLD GEN.

CAPY @ 115°COND TEMP \$ +2°LWT. = 151.6 TONS R.

KW = 229.4 × 1.030 × 0.99 = 222.1

KW/TON = 222.1/151.6 = 1.465.

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PRICE FOR ESTIMATING.
ROLER HUBERT 779-0787

JOB WSMR - ESOS STUDY	₹ 1110,000
SHEET NO.	_ OF1
CALCULATED BY C. Butte	DATE 3:11.92
CHECKED BY	DATE
SCALE	

PROM TRANG: @ 115°F AMB TEMP., 42° LWT

ALT., IA. - RTAA 200 142,3T.

ALT. 1B - RTHA 150? 142.3T (80°-95° COND St, 55°-42' EVAP ST) (30% GLYCOL SOLN)

ALT. 2A - RTAA 140 113.5T. (30% GLY(OL SOLN)

ALT, 2B - RTHA 130 113,57 (80°-95°COND At, 55°-42'EVAP AT)

Y-D Starters.

200LING TOWERS FROM BAC, BOBLINDE

ATT. 18
3165 JE165 \$13,730 +400.06 (HTR) 3 HP & 10 HP (BRERY MISER)

ALT. 26
3130 JE130 \$12000 HNCL. 400,00 2 HP & 5 HP (""")

NSE 2 WWOING STARTER.

USE 1200 FOR INSTALLATION (48 MH @ \$25.00/MH)

Denver · Colorado Springs · Atlanta · Germany LAUNCH COMPLEX = 28 ALTS IA, IB, ZA, ZB	CALCULATED BY C. PLATICAL CHECKED BY SCALE	
COST ESTIMATING: REF! RICH 1. SECTION 2-17. STRUCTURAL P. 3 TRENCH 24" WIDE X 3 OUTPUT: 131.8 C4/HG	EXCAVATION W/ CLEVELA 3'-0" DEEP IN CLASS A &	AND JS-36 TRENCHER
COSTS: EQUIP. TRENCHER @ 68,50 PICKUP TRUCKER 9.50 78.00	/HR	
	65/HR	43,80/HR
2. SECTION 2.12, P.1 VOLUME OF 3'.0" DEBTH = .1112 C9/FT FOR 24" WIDTH = (2x.1112) +	NIDTH X FT LENGTH + .0556	
TIME REQD = 131.8 CY/HR 0.278 CY/LF ALT IA: 6012/474.1 = 12.7 ALT IB; SAME 2.7 ALT. 2A: 1000/474.1 = 2.1 ALT. 2B: SAME	3 SAU 1/ 110 VIAA (100 1)	\$240 ≅ ^{\$} 2550 ≅ ^{\$} 2550 ≈ ^{\$} 820 ~ ^{\$} 820

JOB WSMR ESDS STUDY # 1110.000

E M C ENGINEERS, INC. Denver • Colorado Springs • Atlanta • Germany LAUNCH COMPLEX # 38 JOB WSUR 500 STUDY * 1110.000 SHEET NO. 2 OF CALCULATED BY C. Putler DATE 3.12-97 CHECKED BY DATE

3. SECTION 2-21, P.Z: STRUCTURAL BACKFILL & COMPACTION

FOR 6" LIFTS: CLASS"A" MATERIAL

OUTPUT = 25 CY/HR (BANK MEASURE)

COSTS:

ALTS 1A, 1B, 2A, 2B.

EQUIP & LABOR TOTAL \$ 179.30/HR

TIME REGD .:

@ 0.278 CY/LF + 25 CY/HR. = 0.01112 HR/LF

ALT 1A 6012 LF x 0.01112 HR/LF = 66.9 SA4 68 HRS.

1B SAMTE = 68 HRS.

2A 1000 LF x 0.01112 HR/LF = 11.12 SAF 12 HRS

2B SAME = 12 HRS

ALT. 1A 68 HRS x\$179.30/HR. + \$125 MOVE-DN COSTS = \$12,220.

1B 2A 12 1705 x\$1749.30/HK + \$125 MOVE-ON COSTS = \$ 2280.

26

4. SECTION Z-14, p.2, STRUCTURAL EXCAVATION WITH A CASE 580 LOADER-BACKHOOL
TRENCH 24" WIDE X 3'-0" DEEP IN CLASS A MATL.
OUTPUT: 30.7 C9/HR. (BANK MEASURE)

COSTS:

EQUIP. CASE 580 BACKHOE \$35.00/AR.

PICKUP TRUCK 9.50/HR

\$ 44.50/HR.

CREW: FOREMAN \$ 24.15/HR

OPERATOR \$ 23.65/HR

LABORER \$ 18.00/HR \$ 65,80/HR

EQUIP & CREW TOTAL \$110.30/HR.

5. FROM PARA. 2; p. 1

TIMEREAD = 30.7 CY/HR = 110.4 LF/HR

ALT. 1A & 1B: 720 LF / 110,4 LF/HR = 6.5 SAY 12 HRS ALT. 2A & 2B: 280 LF / 110,4 LF/HR = 2.5 SAY 5 HRS

ALT. 1A & 1B; 12 HRS x\$110.30/HR =\$1325 ALT. 2A & 2B: 5 HRS x\$110.30/HR =\$550

Denver • Colorado Springs • Atlanta • Germany LAUNCH COMPLEX #38 ALTS 1A, IB, 2A, ZB

JOB <u>WSMR</u>	ESDS STUDY	r #1110,000
SHEET NO.	4	OF
CALCULATED BY	2. Butler	DATE 3 .12.92
CHECKED BY		DATE

6. PAVEMENT:

A. PAVEMENT REMOVAL:

ALT. IA & IB. APPEDX 400 SQ FT & 4"THE = 4.9 CY (\$\approx 400 \mathrm{L} = \alpha.9 CY)

ALT, 2A & 2B: APPROX 260 SOFT × 4"THK = 3,2 CP (\$\sum_{260} LF cut)

1. PET: MEANS 020 728 0010,0020: SAW CUTTING TO 4" DEPTH.

MATL .22+.05 = $\frac{9.27}{LF}$

LABOR AZ+.Z6=\$.68/LF

EQUIP. ,33+,21=\$,54/LF

\$1.49/6

ALT 14 \$ 15, 400 × 1.49 = 600

ALT 2A \$ 2B, 260 × 1.49 = 400

ALT, IA & 1B: 400 LF \$1,49/LF = 600 X1.5 = \$900 - CESCALATED POR SMALLER ALT. 2A & 2B: 260 4 ×1,49/4 = 400 ×1.5 = \$600 - 512E JOB.

1.42

2. BEF: MEANS 020 554 1750, 5550: PAVEMENT REMOVAL & ON-SITE DISPUSAL.

MATL: NONE

LABOR: 193

EDUIP: 2.78. 3.57

£ 4.99/c4 \$4,71/54 +

ACT. 1 A \$ 1 B: 4.71 (400/9) + 4.99 (4,9) = \$240

ALT 24 & ZB: 4.71 (260/4) + 4.99 (3.Z) = \$160

B. REF: MEANS 025 120 0020, 0510; CONCRETE PAVING (SMALL IRREG. AREAS)

MATL: 12.57

LABOR; .59

Equip:

13.75 + 100% =\$27.50/54.

ALT. 1A \$ 1B: 400/9 54. × \$27.50/54 = \$1230

ALT 2A & 2B: 260/9 S.Y. x \$27,50/54 = \$ 800

JOB WEMR ESOS STUDY # 1110,000 SHEET NO. ______ OF ______ E M C ENGINEERS, INC. CALCULATED BY C. Putter DATE 3 . 12 . 92 Denver • Colorado Springs • Atlanta • Germany LAUNCH COMPLEX # 28 SCALE ___ ALTS 1A, 1B 24 2B, 7. CIRCULATING PUMPS: ALT. IA CHILLED BRINE PUMP: 2-273 GPM@ 130' HD WITH ZO HP MOTOR (460/3/60). REF: RICHARDSON, SECTION 15-3, p. 1. PUMP W/MOTOR & BASE : CUSE SOUGPM @ 100' HD , 20 HP MOTOR) MATL; \$3125 -LABOR: \$ 800 - (32 MH 0+25.00/MH). \$ 3925 SAY \$ 4000 EA ALT, IB - CHILLED BRINE PUMP; SAME AS ALT. IA ALT. 1B - CONDENSER WATER PUMP: 2-450 CPM@ 30' HD WITH 7.5 HP MOTOR (460/3/60) REF: RICHARDSON, SECTION 15-3, P.1 PUMP W/MOTOR & BASE: (USE 400 GPM @ 100 HD, 15 HP MOTOR) MATL: \$ 2920 -LABOR \$ 800 - (32 MH @ \$25.00/MH) \$ 3720 - SAY\$3800 EA ALT. ZA - CHILLED BRINE PUMP: 2 - 273 GPM @ 106'HD WITH 15 HP MOTOR (460/3/60) REF: RICHARDSON, SECTION 15-3, P. 1 PUMP W/MOTOR & BASE: (USE 300 GPM @ 100 140, 15 HP MOTOR) MATL: \$2770 -LABOR: \$ 800 -\$3570 - 5A4\$ 3600 EA ALT. 2B - CHILLED BRINE PUMP: (SAME AS ALT. 2A) ALT-2B-CONDENSER WATER PUMP; 2-36+ GPM@ 30' HD WITH 5 HP MOTOR (460/3/60) PUMP W/ MOTOR & BASE : (USE 200 GPM @ 100 HD, 10 HP MOTOR) MATL: \$2150 -LABOR: 5 600 - (24 MH@ \$25.00/MH) \$ 2750- SAY \$2800 EA

D18-35



PROPOSAL

The Trans Company A Division of American Standard Inc.

TRANE COMPANY 5654 GREENWOOD PLAZA BLVD. ENGLEWOOD, COLORADO 80111-23

Customer

MR. CHET BUTLER EMC ENGINEERS

FAX NO:

Number

WHITE

3/12/92

Job Name

WHITE SANDS, NM

Delivery Terms

FOB: FACTORY FREIGHT ALLOWED

Terms of Payment

NET: 30 DAYS

Engineer

EMC ENGINEERS DENVER, CO

BUDGET PRICING

DESCRIPTION: TRANE ROTARY AIR COOLED CHILLER ITEM: A QTY: 1

TAG (S):

1-A

Air Cooled Series R Chiller

200 Tons NOMINAL

460V/60/3

Y Delta Closed Transition Starter w/ Disconnect Switch

U.L. Listing

Deluxe Controller

Architectural Louvered Panels

Control Power Transformer

150 PSI Flow Switch >

FACTORY START-UP SERVICE

TOTAL NET PRICE ITEMS A TO A **\$** 79.500

DESCRIPTION: TRANE ROTARY CHILLER ITEM: B QTY: 1

TAG (S):

1-B

Effective March, 1987, price increase terms will be administered as follows: Prices stated in this proposal are firm provided that notification of release for immediate production and shipment is received at the fectory not later than five months from order receipt. If such release is received later than five months from order receipt date but within eight months of order receipt date, prices will be increased a straight 1.0 percent (not compounded) for each one-month period (or part thereof) beyond the five-month firm

price period up to the date of receipt of euch release, if such release is not recei eight months after data of order receipt, the prices are subject to renegatistion or at the Company's option, the order will be cancelled. If for any reason Buyer delays shipment after release, prices are subject to increase as stated on the reverse side hereof.

D18-36 which this proposal is beend. Prices do not include taxes. See reverse side for terms and conditions of sale upon

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 LC-38 ALT IA

MONTHLY	ENERGY	CONSUMPTION

	ELEC On Peak	DEMAND On Peak	GAS On Peak	GAS DMND On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	66,840	178	1,318	2
Feb	60,345	181	982	1
March	68,703	206	250	0
April	69,087	217	0	0
May	109,405	320	0	0
June	137,885	375	0	0
July	150,515	386	0	0
Aug	143,696	370	0	0
Sept	103,374	315	0	0
Oct	72,431	214	4	0
Nov	64,659	193	484	1
Dec	66,077	183	1,060	1
Total	1,113,018	386	4,098	2

Building Energy Consumption = 47,062 (Btu/Sq Ft/Year)

Source Energy Consumption = 132,276 (Btu/Sq Ft/Year)

Floor Area = 89,425 (Sq Ft)

Z monthly KW FOR CHILLER DLANT = 1494,4

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

----- EQUIPMENT ENERGY CONSUMPTION ------

	Equip						thly Con			_	_		_	
(Code	Jan	Feb	Mar	Apr	May	june	July	Aug	Sep	0ct	Nov	Dec	Tota
ı	LIGHTS													
Į	ELEC	33925	30704	35385	32706	34655	34068	33293	35385	32706	34655	32509	33293	403,28
1	PK	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.
ı	MISC LD													
	ELEC	17742	16039	18152	17125	17947	17516	17556	18152	17125	17947	17087	17556	209,94
ı	PK	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6
: 1	MISC LD													
	GAS	1318	982	250	0	0	0	0	0	0	4	484	1060	4,098
ı	PK	1.8	1.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.4	1.8
1	MISC LD													
ı	OIL	0	0	0	0	0	0	0	0	0	0	0	0	(
-	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ı	MISC LD													
1	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0	•
-	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
١	MISC LD													
-	P HOTH20	0	0	0	0	0	0	0	0	0	0	0	0	1
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
. 1	MISC LD													
-	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0	
-	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	EQ1510.C		RTAA	Air Co	oled Ser	ies R ch	iller							
ı	ELEC	3793	3318	3715	7975	43759	72494	85019	75891	40946	8184	3974	3831	352,90
	PK	14.2	21.2	40.8	65.8	154.0	203.6	214.9	198.6	145.3	63.2	28.1	18.2	1267.9 214.9
ı	EQ5200		CONE	ENSER F	ANS									
	ELEC	206	191	275	466	1869	2993	3472	3093	1782	470	274	222	15,31
1	PK	0.7	0.9	1.7	2.9	6.1	7.8	7.8	7.8	5.8	2.8	1.3	0.8	46,5 7.1
ı	EQ5001		CHIL	LED WATE	ER PUMP	c.v.								
1	ELEC	11100	10026	11100	10742	11100	10742	11100	11100	10742	11100	10742	11100	130,699
1	PK	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	178.8 14.
ļ	EQ5302		CONT	rols										
	ELEC	74	67	74	72	74	72	74	74	72	74	72	74	876
-	PK	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1,2 0.

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1 A-



------UTILITY PEAK CHECKSUMS-----

Utility ELECTRIC DEMAND

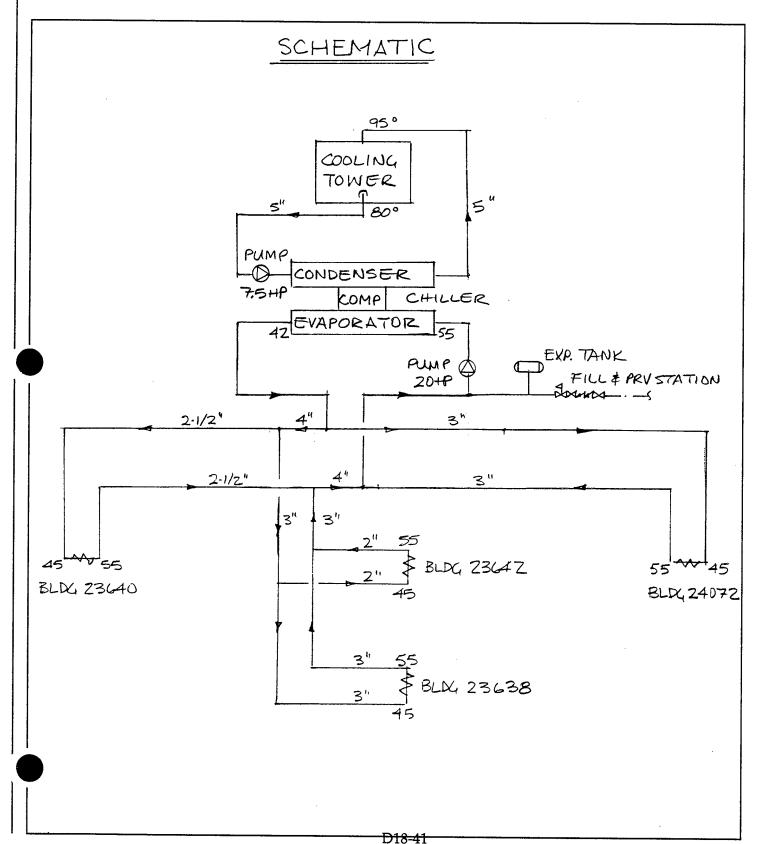
Peak Value 386.4 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num. Cooling E	Equipment Code Name	Utility Demand Equipment Description (kW)	
gooting L	dorbieric		
1	EQ1510.C	RTAA Air Cooled Series R chiller 237.8	61.54
Sub Total		237.8	61.54
Sub Total		0.0	0.00
Sub Total		0.0	0.00
Sub Total	eous	0.0	0.00
Lights		108.1	27.97
Base Uti		0.0	0.00
Misc Equ	ipment	40.6	10.50
Sub Total		148.6	38.46
Grand Tota	al	386.4	100.00

Denver • Colorado Springs • Atlanta • Germany • LAUNCH COMPLEX #38
ALT. # 18

JOB WSMR ESOS STUDY	#1110.000
SHEET NO.	_ OF
CALCULATED BY C. Butler	DATE 3.16.92
CHECKED BY	_ DATE
SCALE	



LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

				•				
		LOCATION: White	e Sands Missile	Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	LAUNCH COM	MPLEX 38 - CHILLER PL	ANT STUDY - ALT. 18	3	FISCAL YEAR:	1992
		DISCRETE PORTIO	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/15/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IN\	/ESTMENT						
	A.	CONSTRUCTION	COST	=			\$703,072	
	В.	SIOH COST		(5.5% of 1A) =			\$38,669	
	C.	DESIGN COST		(6.0% of 1A) =			\$42,184	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$783,925	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$783,925
2	EN	ERGY SAVINGS (+)	/COST (-)					
_		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	4,691	\$30,398	15.23	\$462,957	
	В.	DIST		0	\$0	17.28	\$0	
	C.	PROPANE	\$6.71	0	\$0	19.64	\$0	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		4,691	30,397.7		>	\$462,957
3	NO	N-ENERGY SAVIN	GS (+) / COST ((-)				
				C. DEMAND SAVINGS) 4	. =		\$6,164	
		(ANNUAL RECURF	RING MAINTEN	IANCE COST)				
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	AVINGS (+) / C	OST (-)	(3Å x 3Å1) =		\$90,494	
	В.	NON-RECURRING	§ (+/)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. EQUIP REPLAC	EMENT COST	\$283,750	1	0.96	\$272,400	
		b. EQUIP REPLAC	EMENT COST	\$39,900	5	0.80	\$31,920	
		c.		\$0		0.00	\$0	
		d TOTAL		\$323,650			\$304,320	
	C.	TOTAL NON-ENE	RGY DISCOUN	ITED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$394,814
	D.	PROJECT NON-EI	NERGY TEST					
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$152,776	
		a IF 3D1 => 3C T	THEN GO TO 4					
		b IF 3D1 < 3C Th		TE SIR		(2F5 + 3D1) / 1F =	0.79	
		c IF 3D1b => 1 T						
		d IF 3D1b < 1 TH	IEN PROJECT	DOES NOT QUALIFY				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$49,508
5	то	TAL NET DISCOUN	TED SAVINGS			(2F5 + 3C) =		\$857,771
6	DIS	SCOUNTED SAVING	SS-TO-INVES	TMENT RATIO (SIR)		(5/1F) =		1.09
	(11	F SIR < 1 THEN PRO	DJECT DOES N	OT QUALIFY)				
7	SIN	MPLE PAYBACK (SP	'B)			(1F/4) =		15.83

-	CONSTRUCTION COST ESTIMATE BREAKDOWN	: BREAKD(NWC			Ē	Form Approved			
							Budget Bureau No. 22-R-100	22-A-100		
CONTRACTOR EMC	EMC ENGINEERS INC.			ADDRESS 2750 SOL	JTH WADSW	ORTH BLV	D., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO	D 80227	
OR (Work	CONTRACT FOR (Work to be performed) LAUNCH COMPLEX 38 (ALT 1B)		: :				PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
EQUEST	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORKLOCATION WHITE SAN	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
				MATERIAL COST	LCOST		LABORCOSTS			
	ltem	Unit of	Quantity			Manhours	Average		Other Direct	Line
	€	Measure (2)	ල	Unit	Total	Mandays (6)	Rate	Total (8)	Costs	Total
CHIL 150T	CHILLED WTR GEN, WTR-COOLED 150T (NOM)	EA	1	55800.00	55800	60	35.81	2148.6		\$57,948.60
၁၀၁	COOLING TOWER, 285T	EA	1	14130.00	14130	48	35.81	1719		\$15,848.88
PUN	PUMP, CENTRIF. 342 GPM, 20 HP	EA	2	3125.00	6250	32	35.81	2292		\$8,541.84
PUN	PUMP, CENTRIF. 456 GPM, 7.5 HP	EA	2	2920.00	5840	32	35.81	2292		\$8,131.84
BIPE	PIPE, INSULATED CONDUIT, 4"	IJ	09	23.50	1410	0.72	35.81	1547		\$2,956.99
PIPE	PIPE, INSULATED CONDUIT, 3"	LF.	6820	18.90	128898	0.57	35.81	139208		\$268,105.79
PIPE	PIPE, INSULATED CONDUIT, 2-1/2"	LF	960	16.30	15648	0.47	35.81	16157		\$31,805.47
PIPE	PIPE, INSULATED CONDUIT, 2"	5	100	16.10	1610	0.38	35.81	1361		\$2,970.78
TR	TRENCH & BACKFILL, 24"x36"	LUMP SUM	3970 LF	2.81	11155.7					\$11,155.70
PAV	PAVEMENT, REMOVE & REPLACE	LUMP SUM	400 SF	5.93	2372					\$2,372.00
PIPE	PIPE, BLK STEEL & FTTGS. 5"	<u> </u>	100	12.58	1258	05.0	35.81	1791		\$3,048.50
EXP	EXPANSION TANK & FILL STA.	ST	1	525.00	525	2.00	35.81	179		\$704.05
00 NO	CONCRETE PAD FOR TOWER	LUMP SUM	6 CY	100.00	600					\$600.00
MISC	MISC. STEEL FOR TOWER	SBT	4000	0.75	3000	0.007	35.81	1003		\$4,002.68
STE	STEEL BUILDING 20'x30'x12'	LUMP	600 SF	30.00	18000					\$18,000.00
	-CONTINUED ON NEXT PAGE-									

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NM							
CONTRACTOR	emc Engineers inc.			ADDRESS 2750 SOL	JTH WADSW	ORTH BLVI	D., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	80227	
CONTINCT	CONTRACT FOR (Work to be performed) LAUNCH COMPLEX 38 (ALT 1B)						PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
				MATERIAL COST	LCOST		LABOR COSTS			
Line	tem.	Chit	Quantity	·		Manhours	Average		Other Direct	
No.	(5)	Measure (2)	(2)	Z €	Total (5)	Mandays (6)	Rate (7)	Total (8)	Costs	Totai (10)
:	VALVE, BFLY, CL. 150, 5"	EA	2	115.00	230	4.8	35.81	344		\$573.78
	VALVE, BFLY, CL. 150, 4"	EA	4	90.00	360	3.2	35.81	458		\$818.37
	INTERCONNECT @ EA BLDG.	Ā	4	7000.00	28000	280	35.81	40107		\$68,107.20
	ETHYLENE GLYCOL	GAL	900	5.90	5310	0.01	35.81	322		\$5,632.29
	SUBTOTAL			-						\$511,324.76
	OVERHEAD & PROFIT (25%) CONTINGENCY (10%)									\$127,831.19 \$63,915.60
	TOTAL THIS SHEET									\$703,071.55
		:								

D18-44

ESTIMATE SUMMARY

ESOS STUDY MSMR PROJECT: ___

36

LAUNCH COMPLEX

1110,000

ESTIMATE NO. ACT. # 1 13

SHEET NO.
PREPARED BY: C. Butle.

DATE: 3-16-92

							- GE	СНЕСКЕВ ВҮ:			DATE:
WAIN X	NOTABLE	VIIII	MATE	MATERIALS		LAE	LABOR		SUB-CONTRACT	NTRACT	
R. 15-1	CHILFDIM	丄	UNIT PRICE	AMOUNT	UNIT M.H.	TOTAL M.H.	RATE	AMOUNT	UNIT PRICE	AMOUNT	TOTAL
	A) (NOM)	- 40 -	25800	55800	00	00	15-	1500			57300
R - 15-2	COOLING TOWER 285T	1 EA	(4,130	14 (30	48	48	25.	1200			(5330
R-15-3	PUMP, CENTIETE, 342CPM, 20HD	2 EA.	3125	6250	32	64	25.	1600			7850
P. 15-3	PUMP, CENTROF. 4566PM, 7.514	26A	2920	5840	32	2	×	1600			7440
M. 151.851.0730	M. FI.SSI. 0730 ADE INSULATED CONDUIT 4"	60LF	23.50	0.4	54,	A	75-	1080			940
.0720	2	6820 LF	1890	128900	5.5	3887	25 -	97180			>26080
0/4P.	2.1/2"	960 LF	16.30	15650	47	45)	25.7	11280			26930
		-17001	16.10	0/9/	.58	200	257	950			2560
R.Z-19,2-19,2-21	TRENCH & PACKFILL, 24"x36"	3970LF							7.81	11160	09111
M.020,025	PAYEMENT REMOVE & REPLAKE	400 SF							5.93	2370	2370
M. 151.701.2120	M. 15.701.2120 PIPE, BLK STEEL + FITUS, 5"	1001	(2.58	1260	0.5	50	755	0,50			2610
	i I										0107
	EXPANSION TANK & FILL STA.	571	525	525	5.0	25	/25-				027
M.033.130.4701 CONCRETE	CONCRETE PAD FOR TOWER	604							001	009	609
M.051-110-0010 MISC.	MISE, STEEL " "	4000185	ĸ	3000	₹00.	28	25.	70.0			7778
M.970-0010	STEEL BUILDING 20'x12'	600 S.F.							100	(1000)	
1										0000	0000
M.151.960.1670 VALVE	BFLY CL 150 5		115	230	4.8	9.6	25.	240			470
0901	* * · · · · · · · · · · · · · · · · · ·	464	90	360	3,2	(2.8	25.	320			680
	INTERCONNECT @ EA BLDG.	4 17 4	3000	28000	230	1120	25-	28000			26000
M.157.401.1200	ETHYLENE QUYCOL	900GAL	5.90	5310	100	6	25	230			5540
	TOWER WATER TREATMENT.						-				
										1	
*	R = RICHARDSON ESTIMATING CUIDE	7	= MERALS	- 1	EXTINATING CLINE	- PAINS				4	447, (260)
					28//) 1					

JOB WSMR ESDS STUDY # 1110,000

CHEET NO

SHEET NO.		 ′ –			
	R. 41	 	2	11.	a >

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

LAUNCH COMPLEX #38 ALT. # 12

A. WATER-COOLED CENTRIFUGAL SERVING 23640, 23642, 23638 & 24072

SCALE

1. EVAPORATOR:

USING APPLICABLE DATA FROM ALT. # 1 A:

GPM = 342

HEAD = 145+15+50 = 2101

CAPY = 152,0 TONS R.

2. CONDENSER:

GPM = 152.0 TONS R. x 3.0 GPM/TON. = 456 GPM

HEAD:

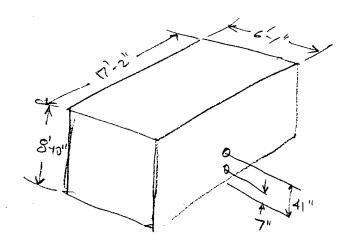
101 STATIC:

201 P.D. COND .:

301

PUMP HP = 1.7 × 456 × 3.0/3960 × 0.7 = 5.92 SAY 7.5 HP.

3. COOLING TOWER SELECTION: (SEE ATTACHED BAC SELECTION SHEET)



WITH 10 HP FAN MOTOR.

Ε	M	C	EN	GIN	EERS,	INC.	

Denver • Colorado Springs • Atlanta • Germany

JOB	
SHEET NO.	OF
CALCULATED BY	DATE
CHECKED BY	_ DATE
SCALE	

GPM SIZE P.D. /100 LF LENATH P.D. CUM.P.D. 53 2-1/2" 2.13 5430 115.66 3" 0.736 " 39.965 Say 40

40 + 15 + <u>50</u> 105 | compares w/ P.D. in alt. 2A. INPUT FILE NAME : C:\JOBS\EMC\WHITE\RTHA.FRE

PROJECT : WHITE SANDS PROJECT

LOCATION : NEW MEXICO

BUILDING OWNER

ROGRAM USER : RCH

JOMMENT : FOR CHET BUTLER

EPS FLAG : Y

**** INPUT CONDITIONS **	*** *****		******
MACHINE TAG	(1-B)	MOTOR KW SIZE	
COMPRESSOR SIZE	150	VOLTAGE	460
SHELL TYPE	LONG	FREQUENCY	60
DESIGN DUTY		MAX KW/TONS	
DESIGN KW		REFRIGERANT	22
EG			
			•
EXITING EVAP TEMP	42	ENTERING COND TEMP	80
EVAP FLOW RATE		COND FLOW RATE	
ENTERING EVAP TEMP	5 5	EXITING COND TEMP	9 5
EVAPORATOR PASSES	.3	CONDENSER PASSES	2
EVAP FOULING FACTOR	0.00025	COND FOULING FACTOR	0.00025
MAX EVAP PRESSURE DROP	••••	MAX COND PRESSURE DROP	
BUILT BY	PUEBLO	COND TUBE TYPE	STD
BRINE TYPE	EG	BRINE TYPE	
BRINE %	30	BRINE %	•
		*********	****
		HE ARI CENTRIFUGAL AND	
ROTARY WATER CHILL		•	•

803 AMPS

170 AMPS 151 AMPS

5857 LBS

6290 LBS

D18-48

	•	
MODEL RTHA SHELL LENGTH DESIGN DUTY POWER CONSUMED KW PER DESIGN DUTY	- ·	TONS KW
EXIT EVAP TEMP	42.0	
EVAP FLOW RATE	293	
ENTERING EVAP TEMP	55.0	•
EVAPORATOR PASSES	. 3	
EVAP PRESSURE OROP	<u>-</u> -	FEET
EVAP FOULING FACTOR	0.00025	
EVAP BRINE TYPE	EG	
EVAP BRINE PERCENT	30	
EVAP BRINE FREEZE PT	5.1	F
ENTERING COND TEMP	80.0	F
COND FLOW RATE	282	GPM
EXIT COND TEMP	95.0	F
CONDENSER PASSES	2	
COND PRESSURE DROP	9	FEET
COND FOULING FACTOR	0.00025	
COND BRINE TYPE	WATER	
COND BRINE PERCENT	0	
COND TUBE TYPE	STANDARD	
NOMINAL MOTOR KW	121	KW

MAX LRA AT NOMINAL MOTOR KW

RLA AT MOTOR KW

OPERATING WEIGHT

SHIP WEIGHT

RLA AT SELECTION KW

SERIES 3000 SELECTION CHART

ENTERING WET BULB °F

84°

9.0

8.0

7.0

6.0

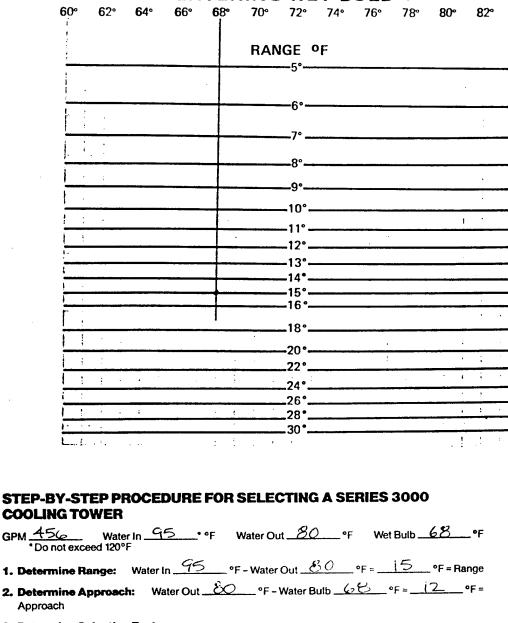
5.0

4.0

3.0

84

SELECTION FACTORS



3. Determine Selection Factor

Entering at the design Wet Bulb temperature, project a line vertically downward to intersect the Range determined above. From this point project a horizontal line to the right intersecting the Approach curve at that temperature determined above. Then project a line vertically downward to intersect the design Wet Bulb line. Read the Selection Factor at this point.

Selection Factor = 4.5 - 4.6

4. Select Unit

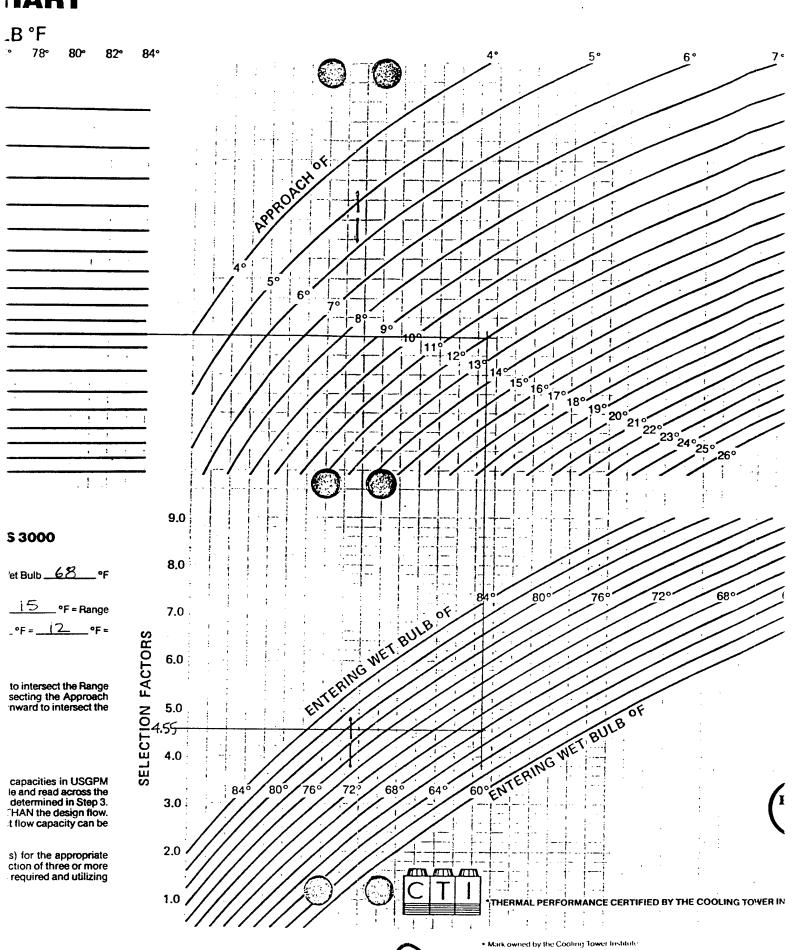
Turn to the Series 3000 Capacity Tables on page 10 which tabulate the tower capacities in USGPM for Selection Factors ranging from 0.50 to 9.00. To select a tower, enter the table and read across the Selection Factor line to a factor EQUAL TO OR JUST LESS THAN the factor determined in Step 3. Read down the column until reaching a flow rate EQUAL TO OR GREATER THAN the design flow. Read the tower model number from the column on the left. If desired, the exact flow capacity can be found by interpolating directly between listed selection factors.

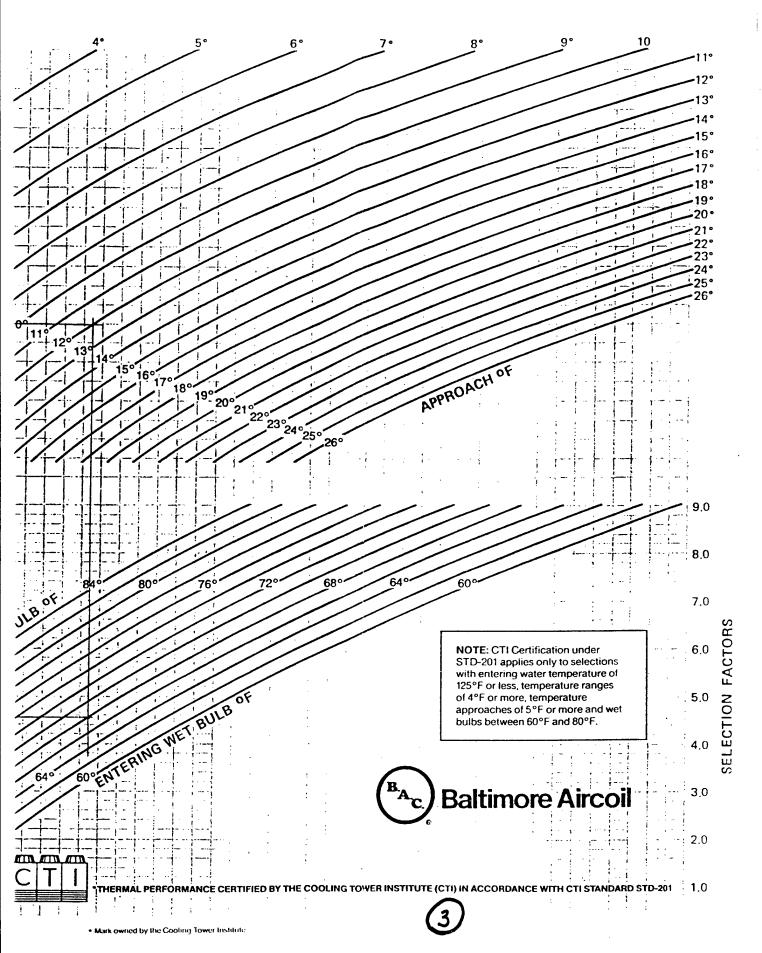
If the required flow rate exceeds all values shown in Table 1 (single cell units) for the appropriate Selection Factor, repeat the procedure using Table 2 (Double Cell units). Selection of three or more cells can be obtained by dividing the required flow rate by the number of cells required and utilizing Table 1.

FINAL SELECTION IS MODEL 3165



HART





MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 LC-38 ALT 18

		·
M O N T H L Y	ENERGY	CONSUMPTION

	ELEC On Peak	DEMAND On Peak	GAS On Peak	WATER	GAS DMND On Peak
Month	(kWh)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)
Jan	77,998	187	1,318	35	2
Feb	70,434	188	982	31	1
March	79,638	193	250	33	0
April	78,850	207	0	43	0
May	94,817	230	0	132	0
June	103,324	254	0	199	0
July	110,784	264	0	235	0
Aug	110,542	255	0	213	0
Sept	94,750	234	0	127	0
Oct	85,112	206	4	44	0
Nov	75,008	190	484	33	1
Dec	77,158	188	1,060	34	1
Total	1,058,413	264	4,098	1,158	2

Building Energy Consumption = Source Energy Consumption = 126,023 (Btu/Sq Ft/Year)

44,978 (Btu/Sq Ft/Year)

Floor Area =

89,425 (Sq Ft)

2 monthly KW FOR CHILLER PLANT = 823

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1 β

		_		. .	_	_	umption							0-4-	ef —
Tota		Dec	Nov	0ct	Sep	Aug	July	june	May	Apr	Mar	Feb	Jan	Code	m
														LIGHTS	0
403,28		33293	32509	34655	32706	35385	33293	34068	34655	32706	35385	30704	33925	ELEC	
108.		108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	108.1	PK	
					÷									MISC LD	1
209,94		17556	17087	17947	17125	18152	17556	17516	17947	17125	18152	16039	17742	ELEC	
40.		40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	40.6	PK	
														MISC LD	2
4,09		1060	484	4	0	0	0	0	0	0	250	982	1318	GAS	
1.		1.4	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.5	1.8	PK	
														MISC LD	3
		0	0	0	0	0	0	0	0	0	0	0	0	OIL	
0.		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PK	
														MISC LD	4
		0	0	0	0	0	0	0	0	0	0	0	0	P STEAM	
0.		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PK	
														MISC LD	5
		0	0	0	0	0	0	0	0	0	0	0	0	P HOTH20	
0.		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PK	
														MISC LD	6
		0	0	0	0	0	0	0	0	0	0	0	0	P CHILL	
0.		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PK	
								;	200 TONS	R CTV >	E SERIES	TRAN		EQ1500	1
207,54		10301	9920	11302	20800	32082	35011	27620	19849	11011	10093	9234	10323	ELEC	
81.	7181	18.0	19.8	28.7	51.4	72.5	81.7	72.0	49.7	29.3	22.2	18.6	17.1	PK	
										R	ING TOWE	COOL		EQ5100	1
49,16		0	0	5201	8628	8916	8916	8628	6358	2517	0	0	. 0	ELEC	
12.	84	0.0	0.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	0.2	0.0	0.0	PK	
					٠					R	ING TOWE			EQ5100	1
- 1,1 5		34	33	44	127	213	235	199	132	43	33	31	35	WATER	
0.	41816	0.1	0.1	0.2	0.4	0.5	0.5	0.5	0.4	0.2	0.1	0.1	0.1	PK	
										R PUMP C				EQ5001	1
	_		10742	11100	10742	11100	11100	10742	11100	10742	11100	10026	11100	ELEC	
14.	17818	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	PK	
										TER PUMP				EQ5010	1
49,01		4163	4028	4163	4028	4163	4163	4028	4163	4028	4163	3760	4163	ELEC	
5.	67.2	5.6	5.6	5.6	5.6	5.6	5.6 018-52	5.6	5.6	5.6	5.6	5.6	5.6	PK	

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1 3

Chiller Controls

ELEC 744 672 744 720 744 720 744 720 744 744 744 8,760 720 PK 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 -----UTILITY PEAK CHECKSUMS-----

Utility ELECTRIC DEMAND

Peak Value 263.9 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

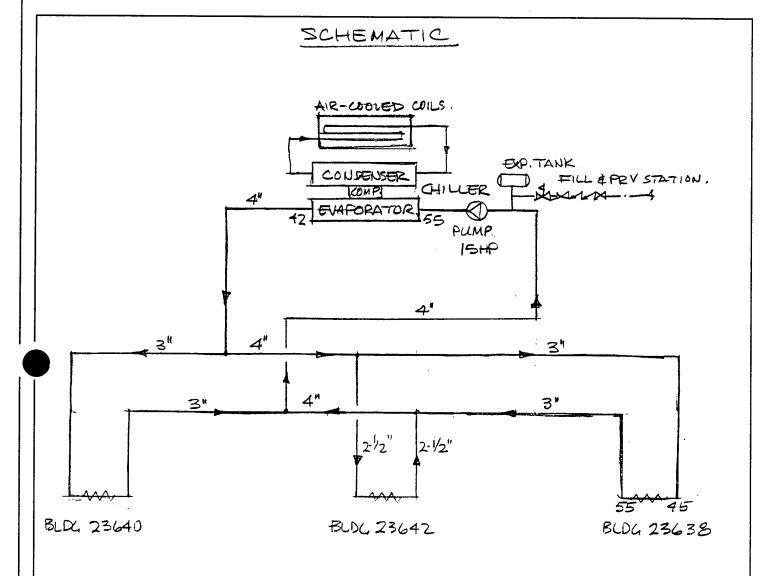
Hour 16 Month 7

_				
Eqp.			Utility	
Ref.	Equipment		Demand	Of Tot
Num.	Code Name	Equipment Description	(kW)	(%)
Cooling	Equipment			
1	EQ1500	TRANE SERIES R CTV >200 TONS	115.2	43.68
Sub Tota	al		115.2	43.68
Sub Tota	al		0.0	0.00
Sub Tota	al		0.0	0.00
Sub Tota	al		0.0	0.00
Miscella	aneous			
Lights			108.1	40.95
Base Ut	tilities		0.0	0.00
Misc Ec	quipment		40.6	15.37
Sub Tota	ıl	•	148.6	56.32
Grand To	otal		263.9	100.00

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LAUNCH COMPLEX #38
ALT # 2A

JOB WSMR ESOS STUDY	# 1110 . 00 0
SHEET NO.	_ OF
CALCULATED BY C. Butler	
CHECKED BY	
	DATE
SCALE	



LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

							•	
		LOCATION: Whi	te Sands Missile Range		REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	LAUNCH COMPLEX	38 – CHILLER PI	LANT STUDY - ALT. 2	A	FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME: TOTAL					
		ANALYSIS DATE:	06/24/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IN	VESTMENT						
	A.	CONSTRUCTION	COST	=			\$325,091	
	В.	SIOH COST		(5.5% of 1A) =			\$17,880	
	C.	DESIGN COST		(6.0% of 1A) =			\$19,505	
	D.	ENERGY CREDIT	(1A + 1B + 1C) =			\$362,477	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	ENT	(1D - 1E) =			>	\$362,477
2	EN	IERGY SAVINGS (+)) / COST (-)					
_		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	Δ	ELEC	\$6.48	3,974	\$25,751	15.23	\$392,193	
		DIST	φυ.+e	3,5/4	\$25,751	17.28	\$392,193	
		PROPANE	\$6.7 1	0	\$0	19.64	\$0	
		PAPER	40.71	0	\$0	10.04	\$0	
		COAL		·	\$0	16.22	\$0	
		TOTAL		3,974	25,751.3	10.22	 >	\$392,193
	• •	101712		0,074	20,701.0			4092,193
3	NO	N-ENERGY SAVIN	IGS (+) / COST (-)					
	_		RING (+/-) (ELEC. DEM/	AND SAVINGS) 4			\$1,547	
			RING MAINTENANCE	•			41,04	
		1 DISCOUNT FAC		,	(From Table A-2) =	14.68		
			SAVINGS (+) / COST (-)		(3A x 3A1) =		\$22,708	
	B.	NON-RECURRING			(OA X OA I) -		Q 22,700	
		ITEM	- ()		YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. EQUIP REPLAC	CEMENT COST	\$283,750	1	0.96	\$272,400	
		b. EQUIP REPLACE		\$0	5	0.80	\$0	
		с.		\$0		0.00	\$0	
		d TOTAL		\$283,750		0.00	\$272,400	
	C.	- · - · · - -	RGY DISCOUNTED SA	•	RT (_)	(3A2 + 3Bd4) =	4 272,400	\$295,108
		PROJECT NON-E		· · · · · · · · · · · · · · · · · · ·	,	(0/2 + 0004) =		φ230,106
	О.		NON-ENERGY CALCU	II ATION		(2F5 x 0.33) =	\$129,424	
		a IF 3D1 => 3C		LATION		(2F5 x 0.33) =	\$128,424	
			HEN CALCULATÉ SIR			(OFE : OD4) / 1E =	1.44	
		c IF 3D1b => 1 1	•			(2F5 + 3D1) / 1F =	1.44	
			HEN PROJECT DOES N	OT OUALIEV				
		3 11 3D10 < 1 IF	LATINOUEDI DOES N	OT GUALIFT				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) / COSTS	(–)	(2F3	+ 3A + (3B1d/25)) =		\$38,648
5	то	TAL NET DISCOUN	ITED SAVINGS			(2F5 + 3C) =		\$687,301
6	DIS	SCOUNTED SAVING	GS-TO-INVESTMENT I	RATIO (SIR)		(5/1F) =		1.90
			OJECT DOES NOT QUA	ALIFY)				
7	SIN	IPLE PAYBACK (SF	PB)			(1F/4) =	•	9.38

ST LABOR Manhours Av Total Mandays I	ST Manhours Total Mandays (5) (6) 58500 64.00	Manhours (5) (6) (5) (6) (58500 (4.00) (5540 32.00)	Manhours Mandays (6) 500 64.00 540 32.00	Manhours (6) (6) (6) (6) (72 (714 0.57	Manhours Mandays (6) (6) 64.00 32.00 0.72 0.72									
1 101	၂၂ 2 💝		tal 0 58500 5540	714 640					Z Z	Manh Manc (6	Manho Mandi (6)	Manhours (6) (6) (64.0 32.0 0.7 0.7 32.0	Manhours Mandays (6) 64.00 32.00 32.00 5.00 5.00 280.00	Mant Mant (6
MATER MATER	MATERIAL CO	MA COS		To To	[5] [2] [3] [4] [4] [5] [5] [5] [5] [6] [6] [6] [6] [6] [6] [6] [6] [6] [6	[8] P 9		58500 58500 5840 5640 5640 1630 1630 1630 455	58500 58500 5840 5640 42714 1630 1630 1630 750	58500 58500 5840 5540 5640 1630 1630 1820 750	58500 58500 5840 5640 5640 1630 1630 1630 750 3000	70tal (5) 58500 58500 5640 42714 42714 455 750 3600 3600 21000	70tal (5) (5) 58500 5840 5640 42714 42714 427 1630 3600 3000 31000 21000	58500 58500 58500 5840 5540 5640 5640 5640 750 750 3000 3000 21000
	5885	L 585	1 585 L	L 585	27 27 0 0	277 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2 2 885	27 27 1 48	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	7 2 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	7 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	7 2 2 2 2 3 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	7 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	7 0 0 1 1 2 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1
e							9 7	8	0	8		8 1 1 1 1 1 1 1 1 1	8 1 1 1 1 1 1 1 1 1	
ltem (1)	Item (1) HILLED WTR GEN, AIR-COOLED 40T (NOM), W/CONTROLS	Item (1) CHILLED WTR GEN, AIR-COOLED 140T (NOM), W/CONTROLS PUMP, CENTRIF, 273 GPM, 15 HP	Item (1) CHILLED WTR GEN, AIR-COOLED 140T (NOM), W/CONTROLS PUMP, CENTRIF, 273 GPM, 15 HP PIPE, INSULATED CONDUIT, 4"	Item (1) CHILLED WTR GEN, AIR-COOLED 140T (NOM), W/CONTROLS PUMP, CENTRIF, 273 GPM, 15 HP PIPE, INSULATED CONDUIT, 4"	(1) CHILLED WTR GEN, AIR-COOLED 140T (NOM), W/CONTROLS PUMP, CENTRIF, 273 GPM, 15 HP PIPE, INSULATED CONDUIT, 4" PIPE, INSULATED CONDUIT, 3"	Item (1) CHILLED WTR GEN, AIR-COOLED 140T (NOM), W/CONTROLS PUMP, CENTRIF, 273 GPM, 15 HP PIPE, INSULATED CONDUIT, 4" PIPE, INSULATED CONDUIT, 3" THENCH & BACKFILL, 24"×36"	Item (1) CHILLED WTR GEN, AIR-COOLED 140T (NOM), W/CONTROLS PUMP, CENTRIF, 273 GPM, 15 HP PIPE, INSULATED CONDUIT, 4" PIPE, INSULATED CONDUIT, 3" PIPE, INSULATED CONDUIT, 2" PIPE, INSULATED CONDUIT, 2-1/2" PRENCH & BACKFILL, 24"×36"	Item (1) CHILLED WTR GEN, AIR-COOLED 140T (NOM), W/CONTROLS PUMP, CENTRIF, 273 GPM, 15 HP PIPE, INSULATED CONDUIT, 4" PIPE, INSULATED CONDUIT, 3" PIPE, INSULATED CONDUIT, 2-1/2" TRENCH & BACKFILL, 24"×36" EXPANSION TANK & FILL STA.	Item (1) CHILLED WTR GEN, AIR-COOLED 140T (NOM), W/CONTROLS PUMP, CENTRIF, 273 GPM, 15 HP PIPE, INSULATED CONDUIT, 4" PIPE, INSULATED CONDUIT, 2" PIPE, INSULATED CONDUIT, 2-1/2" TRENCH & BACKFILL, 24"X36" PAVEMENT, REMOVE & REPLACE EXPANSION TANK & FILL STA. CONCRETE PAD FOR CHILLER	Item (1) CHILLED WTR GEN, AIR-COOLED 140T (NOM), W/CONTROLS PUMP, CENTRIF, 273 GPM, 15 HP PIPE, INSULATED CONDUIT, 4" PIPE, INSULATED CONDUIT, 2" PIPE, INSULATED CONDUIT, 2" PIPE, INSULATED CONDUIT, 2" PIPE, INSULATED CONDUIT, 2" POWEMENT, REMOVE & REPLACE EXPANSION TANK & FILL STA. CONCRETE PAD FOR CHILLER PUMP HOUSING, PREFAB METAL	Item (1) CHILLED WTR GEN, AIR-COOLED 140T (NOM), W/CONTROLS PUMP, CENTRIF, 273 GPM, 15 HP PIPE, INSULATED CONDUIT, 4" PIPE, INSULATED CONDUIT, 2" PIPE, INSULATED CONDUIT, 2-1/2" TRENCH & BACKFILL, 24"×36" PAVEMENT, REMOVE & REPLACE EXPANSION TANK & FILL STA. CONCRETE PAD FOR CHILLER PUMP HOUSING, PREFAB METAL	(1) CHILLED WTR GEN, AIR-COOLED 140T (NOM), W/CONTROLS PUMP, CENTRIF, 273 GPM, 15 HP PIPE, INSULATED CONDUIT, 4" PIPE, INSULATED CONDUIT, 2" PIPE, INSULATED CONDUIT, 2-1/2" TRENCH & BACKFILL, 24"X36" PAVEMENT, REMOVE & REPLACE EXPANSION TANK & FILL STA. CONCRETE PAD FOR CHILLER PUMP HOUSING, PREFAB METAL VALVE, BFLY, CL 150, 4" INTERCONNECT @ EA BLDG.	3" 5 HP 3" 3" 3" 3" 3" 3" 3" 3" 3" 3" 3" 3" 3"	Item (1) CHILLED WIR GEN, AIR-COOLED 140T (NOM), W/CONTROLS PUMP, CENTRIF, 273 GPM, 15 HP PIPE, INSULATED CONDUIT, 4" PIPE, INSULATED CONDUIT, 2-1/2" PIPE, INSULATED CONDUIT, 2-1/2" PREMCH & BACKFILL, 24"×36" PAVEMENT, REMOVE & REPLACE EXPANSION TANK & FILL STA. CONCRETE PAD FOR CHILLER CONCRETE PAD FOR CHILLER PUMP HOUSING, PREFAB METAL VALVE, BFLY, CL 150, 4" SUBTOTAL OVERHEAT & PROFIT (25%)
Measure	of Measure (2) EA	of Measure (2) EA	Of Quan Measure (2) (3) ED EA IP EA	Of Oua Measure (2) (3) (4) (4) (5) (5) (7) (7) (7) (7) (7) (7) (7) (7) (7) (7	Of Oua Measure (2) (3) (4) (4) (4) (5) (4) (4) (4) (4) (4) (4) (4) (4) (4) (4	Measure Qua Qua	Of Quadratic Q	Of Quadratic Q	Of Oua	of Oua Measure (2) (3) (4) (6) (6) (6) (6) (7) (6) (7) (7) (7) (7) (7) (7) (7) (7) (7) (7	Of Oua Measure (2) (2) (3) (4) (4) (4) (5) (5) (6) (6) (6) (6) (6) (6) (6) (6) (6) (6	Of Oua Measure (2) (2) (3) (2) (4) (4) (4) (4) (4) (4) (4) (4) (4) (4	Of Oua Measure (2) (2) (3) (2) (4) (4) (4) (4) (4) (4) (4) (4) (4) (4	Of Oua Measure (2) (2) (3) (4) (4) (5) (5) (6) (6) (6) (6) (7) (6) (6) (7) (6) (7) (7) (7) (7) (7) (7) (7) (7) (7) (7
	(-) (-) (-) (-) (-) (-) (-) (-) (-) (-)	EA 1	ED EA 1 IP EA 2 LF 240	ED EA 1 IP EA 2 LF 240 LF 2260	ED EA 1 IP EA 2 LF 240 LF 2260 1/2" LF 100	HP EA 2 HP EA 2 " LF 240 " LF 2260 -1/2" LUMP 1300 LF	LED EA 1 HP EA 240 " LF 240 -1/2" LUMP 1300 LF SUM 1300 LF LUMP 260 SF	LED EA 1 HP EA 2 " LF 240 -1/2" LF 100 LUMP 300 LF SUM 1300 LF SUM 260 SF LES 10	ED	EA 1 EA 2 LF 240 LLIMP 1300 LF SUM 1300 LF LUMP 260 SF SUM 260 SF SUM 7.5 CY LUMP SUM 7.5 CY LUMP SUM 7.5 CY LUMP SUM 7.5 CY	EA 1 EA 2 LF 240 LF 2260 LUMP 1300 LF SUM 1300 LF SUM 260 SF SUM 7.5 CY LUMP SUM 7.5 CY SUM 7.5 CY SUM 100 SF SUM 100 SF	2-1/2"	2-1/2"	DLED

ESTIMATE SUMMARY

DATE: 3.16.92 74910 580 2960 3000 7140 1820 00100 3650 750 680 2030 42,000 09,430 TOTAL DATE: 028 3650 95 U 3000 UNIT PRICE | AMOUNT SUB-CONTRACT 7 Butle 30 4 000 2.81 ALT Ċ. 1500 1600 4320 32200 1180 320 Ø 125 21000 AMOUNT PREPARED BY: ESTIMATE NO. CHECKED BY: SHEET NO. 25 25 25 25 25 25 25 77 RATE LABOR TOTAL M.H. 173 4 840 8.21 40 47 W h m 4 UNIT M.H. 35 57-57-47-3,2 280 Ú, 0,0 #1110.000 360 5640 1630 5540 21000 1950 58,500 58500 42710 433 AMOUNT MATERIALS 18.90 23.50 UNIT PRICE 2770 2000 405 5.90 0 260 SF 330GAL 240 LF 1300 LF 100SF 2260LF 7.504 sh sh QUANTITY BOLF E4. 2 EA. 4 币A STUDY 3 6A こっ # 2-12" R.2-42-17.2-21 TREACH & PACKETLL, 24" x32" M. 020,025 PAVEMENTNT, REMOVE & REPLACE PUMP, CANTRIE, 2734AM, 15HP EXPANSION TANK & FILL STA. M.970.0010 PUMP HOUSING, PREFIAB METAK INTERCONNECT @ 64 BLDG AIR-COOLETS 3 M.OB. 134701 CONCRETE PAD FOR CHILLER , W/ CONTROLS COMPLEX <u>4</u> 4-**ES0S** M. 151.851.0730 PIPE, INXVILATED CONDUIT, M.151-960-1020 VALVE, 8FLY CL 150, ETHYLENE GLYCOL DESCRIPTION = HILED MTR CEEN. 140 T (NOM) LAUSOT = MSMR M.157-401.1200 MAIN 5-3 ふり PROJECT: D18-58

E M C ENGINEERS, INC. CALCULATED BY ___ Denver • Colorado Springs • Atlanta • Germany SCALE 学 BLDGS. 23640,23642 \$ 23638 2A. AIR-LOOLED 15 HP CIRC. PUMP. RTAA 140 5 - 1.5 HP COND. FANS. 23638) EKW = 2,667 ZKWH= 830,127 23640 236425 24072 ZKW = 724 ZKWH= 438,375 TOTAL SKW = 3,391 5 KWH = 1,268,502 \$128,069 /yr. AUNUAL MUTCE WIT: CENT, PLANT 24072 14n. * TOTAL CONSTRUCTION COST WTR COULED 15 HP CIRC PUMP. 5 HP COND PUMP. RTHA 130 5 HP COOLS TWR FAN.

JOB _ LAUNCH COMPLEX 38

-2.3.17117/ VCBD

PROPOSAL

Number WHITE

Page

The Trans Company A Division of American Standard Inc.

SENT BY HAYNES IRANE

WATER COOLED SERIES R CENTRAVAC

150 NOMINAL TONS

460V/60/3

LONG LENGTH SHELLS

3 PASS EVAPORATOR, 150 PSI EVAPORATOR WATER PRESSURE

2 PASS CONDENSER, 150 PSI CONDENSER WATER PRESSURE

UL LISTED

UNIT MOUNTED. STAR DELTA STARTER W/ DISCONNECT, VOLT & AMMETERS

FACTORY INSULATION >

FLOW SWITCHES >

FACTORY START-UP SERVICE

TOTAL NET PRICE ITEMS B TO B

DESCRIPTION: TRANE ROTARY AIR COOLED CHILLER ITEM: C QTY: 1

:AG (S): 2-4

Air Cooled Series R Chiller

140 Tons NOMINAL

460V/60/3

Y Delta Closed Transition Starter w/ Disconnect Switch

U.L. Listing

Deluxe Controller

Architectural Louvered Panels

Control Power Transformer 150 PSI Flow Switch

FACTORY START-UP SERVICE

TOTAL NET PRICE ITEMS C TO C ***** \$ 58,500

ITEM: D DESCRIPTION: TRANE ROTARY CHILLER QTY: 1 TAG (S):

2-B

WATER COOLED SERIES R CENTRAVAC

130 NOMINAL TONS 460V/60/3

>

LONG LENGTH SHELLS

> 3 PASS EVAPORATOR, 150 PSI EVAPORATOR WATER PRESSURE 2 PASS CONDENSER. 150 PSI CONDENSER WATER PRESSURE

D18-60



PROPOSAL

WHITE

The Trane Company A Division of American Standard Inc.

Page

Number

ULLISTED UNIT MOUNTED, STAR DELTA STARTER W/ DISCONNECT, VOLT & AMMETERS

EACTORY INSULATION

FACTORY START-UP SERVICE

TOTAL NET PRICE ITEMS D TO D \$ 47,100

RESPECTFULLY SUBMITTED.

RCT

ROGER C. HUBERT SALES ENGINEER

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

LAUNCH COMPLEX *38

ALT. # 2A

JOB WSMR EDDS STUDY	# 1110.00 U
SHEET NO	_ 0f5
CALCULATED BY C. Butler	DATE 3-4-92
CHECKED BY	DATE
20415	

ALT. # ZA AIR-COOLED COLD CONTRATOR SERVING 23640, 23642 \$ 23638

A. @ 2.4 GPM / TON R.; GPM FLOWS TO EA. BLDG ARE:

- 1. BLBG. 23640: 2.4 GPM/TON × 36.2 TON DESIGNAX = 87 GPM
 87 GPM THRU 3" BLK STL PIPE; 3.8 fps. \$ 1.83 /100 CF.
- 2. BLD4. 23642: 2.4 GPM / TON × 32.3 TONDESIGN PK = 78 GPM.

 78 GPM THRU 21/24 BLK STL PIPE: 5.2 FPS & 4.42 1/100 LF.
- 3. BLDG 23638: 2.4 GPM/TON x 45 TON DESIGN PK = 108 GPM.

 108 GPM THRU 3 BLK STL PIPE: 4.7 Fps \$ 2.75 1/100 LF

 4. BLDG 23642 \$ 23638: 78 + 108 = 186 GPM.

186 CPM THRU 4"BLK STL PIPE: 4.7 Fps \$ 1.97 1/100 LF.

5, ALL BLDS: 87 + 78 + 108 = 273 GPM

273 GPM THRU 4" BLK STL PIPE: 6.9 Fps \$ 4.10 1/100 LF.

B, LENGTHS OF PIPE:

2-1/2": 50 LF S + E = 100 LF.

3": 1130 LF SQR = 2260 LF.

4" : 120 LF 84R = 240 LF.

C. ESTIMATED PUMP HEAD:

650' @ 2.75 /100 LF = $17.875 \times 2 \approx 36.0$ '

90' @ 1.97'/100 LF = $1.773 \times 2 \approx 3.2$ '

30' @ 4.10'/100 LF = $1.230 \times 2 \approx 2.5$ ' 41.7+ 107, FITTINGS = 4.2+ CHILLER P.D. 10.0

+ EST. BLOG P.D. 50.0

105,9 544 1061

	JOB WSMR ESOS STUDY # 1/10 . 000
E M C ENGINEERS, INC.	SHEET NO OF 5
Denver • Colorado Springs • Atlanta • Germany	CALCULATED BY C. Butler DATE 3.4-92
LAUNCH COMPLEY = 39	CHECKED BY DATE
ALT. # 24	SCALE
D. ESTIMATED PUMP HORSEPP	DWER:
BHP = GPM × HD x S	OCR = 273 × 106 × 1.04
3960 × 255	$\frac{273 \times 106 \times 1.04}{3960 \times 0.70} = 10.86$
	w% = 13.03 USE 15 HP
•	13.03
E. CHILLER GLECTION:	
TOTAL CAPY: (DESIGN PK)	
BLDG 23640	32,3
BLD4 23642	36. 2
BLD4 23638	45.0
	1135 TON R. @ 115° AMB TEMP.
	~ 4000 ELEV.
	30% CLYCOL SOLN (BY WT.)
FROM ATTACHED PERFORMANCE ADJ	
	EV. CAPY = x 0.960 KW = x 1.03
FOR 307, BRINE JOLN:	$CAPY = \times 0.975$ KW = $\times 0.988$
CAPY ADJUSTED:	

113.5 = 121.370N R. 0,960x0,975

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

LAUNCH COMPLEX 38 ALT. = 2A

JOB WEMR	FSOS STUDY	# 1110.000
SHEET NO.	3	OF5
CALCULATED BY	. Butler	DATE 3.6.72
CHECKED BY		DATE
SCALE		

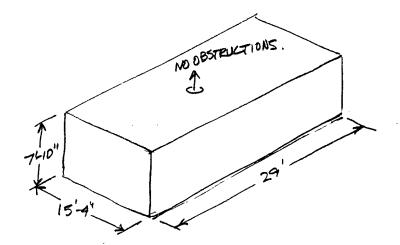
F. AIR-COOLED COLD GENERATOR SELECTION;

SELECT A TRANE RTAL 140. @ COND AIR TEMP= 1150F, LWT 420*

CAPY = 127.4 TON R.

KW = 202,5 × COPRECTIONS = 202.5 × .99 × 1.03 = 206,5

* LWT@ +2° ALLOWS FOR 2-3°F PICK-UP IN CIRCULATING PIPING.



DIMS INCLUDE WORKING CLEARANCE AROUND MACHINE.



Performance Adjustment Factors

WSMR ESOS STUDY #1110.000 SHEET 4 OF 5

C. BUTLER 3.6.92

LAUNCH COMPLEX # 38

ALT: # 2 A

Table 19-1 — Performance Data Adjustment Factors

	Chilled						Altin	ude					
Fouling	Water		Sea Level			2000 Feet			4000 Feet			6000 Feet	
Factor	ΔΤ	CAP	GPM	KW									
	6	0.987	1.650	0.993	0.967	1.640	1.003	0.952	1.620	1.019	0.932	1.570	1.029
•	8	0.993	1.250	0.997	0.973	1.240	1.007	0.956	1,220	1.025	0.935	1.190	1.035
0.00025	10	1.000	1.000	1.000	0.980	0.990	1.010	0.960	0.970	1.030	0.940	0.940	1.040
	12	1.007	0.820	1.003	0.987	0.810	1.013	0.966	0.800	1.035	0.945	0.780	1.045
	14	1.013	0.710	1.007	0.993	0.700	1.017	0.972	0.680	1.038	0.952	0.660	1.048
•	16	1.020	0.640	1.010	1.000	0.630	1.020	0.980	0.620	1.040	0.960	0.600	1.050
	6	0.967	1.630	0.983	0.958	1.610	0.993	0.938	1.590	1.002	0.918	1.550	1.012
	8	0.973	1.230	0.987	0.964	1.220	0.997	0.944	1.200	1.005	0.925	1.180	1.016
0.00075	10	0.980	0.980	0.990	0.970	0.970	1.000	0.950	0.950	1.010	0.930	0.930	1.020
•	12	0.987	0.800	0.993	0.975	0.800	1.003	0.955	0.780	1.015	0.934	0.770	1.026
	14	0.993	0.690	0.997	0.978	0.680	1.007	0.958	0.660	1.022	0.937	0.650	1.032
•	16	1.000	0.620	1.000	0.980	0.610	1.010	0.960	0.600	1.030	0.940	0.590	1.040

Figure 19-1 — Ethylene Glycol Performance Adjustment Factors and Solution Freezing Points

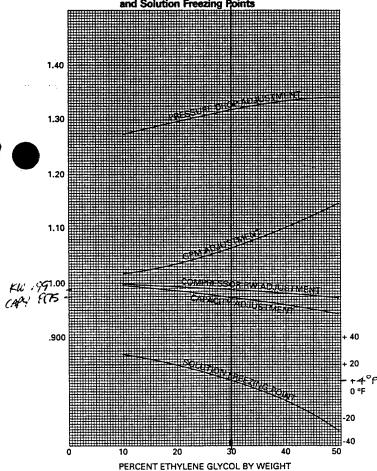
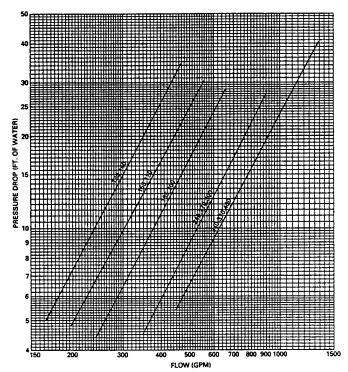


Figure 19-2 — Evaporator Water Pressure Drop





Performance Data

WSMR ESOS STUDY #1110.000

SHEET S OF 5

CBUTLER 3.6.92

LAUNCH COMPLEX = 38 ALT, = ZA



Table 20-1 - RTAA 130 Performance Data

						Entering	Condense	r Air Temp	erature (D	egrees F)					
LWT		75			85			95			105			115	
(Deg F)	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER
40	147.5	122.4	13.0	139.7	135.1	11.3	131.6	149.7	9.7	123.1	166.3	8.2	114.3	185.0	6.9
42	152.6	124.5	13.2	144.6	137.2	11.5	136.2	151.9	9.9	127.5	168.6	8.4	118.3	187.3	7.1
44	157.8	126.6	13.5	149.6	139.4	11.7	141.0	154.2	10.1	131.9	170.9	8.6	122.5	189.7	7.3
45	160.5	127.6	13.6	152.1	140.5	11.9	143.4	155.3	10.2	134.2	172.1	8.7	V124.8	190.9	73
46	163.2	128.7	13.7	154.7	141.6	12.0	145.8	156.5	10.3	136.4	173.3	8.8	126.7	192.1	7.4
48	168.6	130.9	14.0	159.9	143.9	12.2	150.7	158.8	10.5	141.0	175.8	9.0	130.7	194.7	7.6
50	174.1	133.2	14.2	165.1	146.3	12.4	155.6	161.3	10.7	145.7	178.3	9.1	129.9	186.9	7.8
55	188.3	139.1	14.8	178.7	152.4	12.9	168.4	167.7	11.2	157.7	184.9	9.6	135.4	182.3	8.3

Table 20-2 — RTAA 140 Performance Data

	Entering Condenser Air Temperature (Degrees F)														***************************************
LWT		75		85				95			105		115		
(Deg F)	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER
40	159.4	132.4	13.1	150.9	146.1	11.3	142.0	161.9	9.7	132.7	179.8	8.3	123.1	199.9	6.9
42	164.9	134.6	13.3	156.2	148.5	11.6	147.0	164.4	9.9	137.4	182.3	8.4	127.4	202.5	7.1
44	170.5	136.9	13.6	161.5	150.9	11.8	152.0	166.8	10.1	142.1	184.9	8.6	124.5	190.5	7.3
45	173.3	138.1	13.7	164.2	152.1	11.9	154.5	168.1	10.2	144.5	186.2	8.7	126.7	191.7	7.4
46	176.2	139.3	13.8	166.9	153.3	12.0	157.1	169.4	10.3	146.9	187.6	8.8	127.0	189.3	7.5
48	182.0	141.8	14.0	172.4	155.9	12.2	162.3	172.0	10.5	151.7	190.3	9.0	129.5	188.1	7.7
50	187.9	144.3	14.3	178.0	158.5	12.4	167.6	174.8	10.7	156.7	193.1	9.1	132.1	186.8	7.9
55	203.0	150.8	14.8	192.3	165.3	12.9	181.1	181.9	11.1	169.3	200.5	9.5	135.3	177.9	8.5

Table 20-3 — RTAA 155 Performance Data

						Entering	Condense	r Air Temp	erature (C	Degrees F)						
LWT		75			85		95				105			115		
(Deg F)	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	
40	166.4	140.2	12.9	158.0	155.0	11.2	149.3	171.8	9.6	140.0	190.6	8.2	130.4	211.5	6.9	
42	172.5	142.6	13.1	163.9	157.5	11.4	154.8	174.4	9.8	145.2	193.3	8.4	135.2	214.2	7.1	
44	178.8	145.1	13.4	169.8	160.1	11.7	160.4	177.0	10.0	150.5	196.0	8.6	134.6	205.9	7.3	
45	181.9	146.3	13.5	172.8	161.4	11.8	163.2	178.4	10.2	153.1	197.4	8.7	137.0	207.2	7.4	
46	185.1	147.6	13.7	175.9	162.7	11.9	166.1	179.7	10.3	155.8	198.8	8.8	138.0	205.8	7.5	
48	191.5	150.2	13.9	182.0	165.3	12.1	171.9	182.5	10.5	161.3	201.6	9.0	137.0	197.5	7.7	
50	198.1	152.8	14.2	188.3	168.1	13.4	177.8	185.3	10.7	166.8	204.5	9.1	137.2	191.8	8.0	
55	214.9	159.6	14.8	204.3	175.2	12.9	193.0	192.7	11.2	181.0	212.2	9.6	136.1	175.5	8.6	

Table 20-4 — RTAA 170 Performance Data

						Entering	Condense	r Air Temp	erature (C	Degrees F)						
LWT		75		85				95			105			115		
(Deg F)	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	Tons	KW	EER	
40	184.0	157.4	12.7	174.7	172.9	11.1	165.2	190.7	9.6	155.5	210.8	8.2	133.6	210.5	7.1	
42	190.3	160.3	129	180.7	175.8	11.3	171.0	193.7	9.8	161.0	214.0	8.4	132.0	201.1	7.3	
44	196.8	163.2	13.2	186.9	178.9	11.5	176.8	196.8	10.0	166.5	217.2	8.6	131.0	192.8	7.5	
45	200.0	164.7	13.3	190.0	180.4	11.6	179.8	198.4	10.1	169.3	218.8	8.7	130.8	190.6	7.6	
46	203.3	166.2	13.4	193.1	182.0	11.7	182.7	200.0	10.2	172.1	220.5	8.7	131.0	188.0	7.7	
48	210.0	169.2	13.6	199.5	185.1	11.9	188.8	203.3	10.3	177.8	223.9	8.9	131.2	182.6	8.0	
50	216.7	172.4	13.8	205.9	188.4	12.1	194.9	206.7	10.5	183.6	227.4	9.1	131.4	177.0	8.2	
55	234.1	180.6	14.3	222.5	196.8	12.6	210.7	215.4	10.9	198.5	236.5	9.5	133.7	166.1	8.8	

1. Ratings based on sea level altitude and evaporator fouling factor of 0.00025 per ARI 550-90.

1. Natings desired of the active all titude and evaporator routing factor of 0.00025 per ARI 550-90.
2. Consult Trane representative for performance at temperatures outside of the ranges shown.
3. KW input is for compressors only.
4. 44 F LWT, 95 F entering air temperature represents ARI rating point.
5. EER = Energy Efficiency Ratio (Btu/watt-hour). Power inputs include compressors, condenser fans and control power.
6. Ratings are based on an evaporator temperature drop of 10 F.
7. 115 F Performance data reflects Adaptive Control⁷⁶ microprocessor control algorithms.



MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 LC-38 ALT. ZA

_		· -	
4			•
•	MONTHLY	ENERGY	CONSUMPTION

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	46,748	147	1,318	2
Feb	42,147	150	982	1
March	48,292	172	250	0
April	49,410	183	0	0
May	83,958	283	0	0
June	107,750	323	0	0
July	116,524	331	0	0
Aug	112,931	317	0	0
Sept	79,262	268	0	0
0ct	52,016	180	4	0
Nov	45,107	162	484	1
Dec	45,980	151	1,060	1
Total	830,127	331	4,098	2

Building Energy Consumption = 59,870 (Btu/Sq Ft/Year)
Source Energy Consumption = 164,894 (Btu/Sq Ft/Year)

Floor Area = 54,167 (Sq Ft)

2 monthly KW FOR CHILLER PLANT = 1406
P24072 = 111.9

ALT ZA = 1517-9

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

----- EQUIPMENT ENERGY CONSUMPTION ------

	Equip						thly Con							
lum	Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	0ct	Nov	Dec	Tota
0	LIGHTS													
	ELEC	18033	16350	19493	17327	18763	18689	17401	19493	17327	18763	17130	17401	216,17
	PK	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.
1	MISC LD													
	ELEC	16519	14933	16813	15960	16666	16235	16391	16813	15960	16666	15923	16391	195,27
	PK	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.
2	MISC LD													
	GAS	1318	982	250	0	0	0	0	0	0	4	484	1060	4,09
	PK	1.8	1.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.4	1.
3	MISC LD													
	OIL	0	0	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
4	MISC LD													
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0	1
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
5	MISC LD													
	P HOTH20	0	0	0	0	0	0	0	0	0	0	0	0	(
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	MISC LD													
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0	•
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	EQ1510.C		RTAA	Air Coc	led Ser	ies R ch	iller							
	ELEC	3611	3108	3349	7575	38511	62205	71516	65601	36289	7765	3685	3590	306,804
	PK	14.2	22.4	38.9	66.6	145.4	186.2	193.8	180.1	130.8	64.2	29.3	18.5	1231,9 193.1
1	EQ5200		COND	ENSER FA	INS									
	ELEC	185	170	237	419	1618	2492	2816	2625	1557	422	241	197	12,978
	PK	0.6	0.8	1.7	2.9	5.6	5.6	5.6	5.6	5.2	2.8	1.3	0.8	38.5 5.6
	EQ5001			LED WATE										
	ELEC	8325	7520	8325	8057	8325	8057	8325	8325	8057	8325	8057	8325	98,024
	PK	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	134,4 11.
	EQ5302			ROLS										
	ELEC	74	67	74	72	74	72	74	74	72	74	72	74	876
	PK	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1,2 0.1

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1



------UTILITY PEAK CHECKSUMS-----

Utility ELECTRIC DEMAND

Peak Value 331.1 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Ec	quipment			
1	EQ1510.C	RTAA Air Cooled Series R chiller	210.7	63.63
Sub Total			210.7	63.63
Sub Total			0.0	0.00
Sub Total			0.0	0.00
Sub Total Miscellane	eous		0.0	0.00
Lights	i+i		86.7	26.18
Base Util			0.0	0.00
Misc Equi Sub Total	plient		33.7	10.18
JETOI GUE			120.4	36.37
Grand Tota	l		331.1	100.00

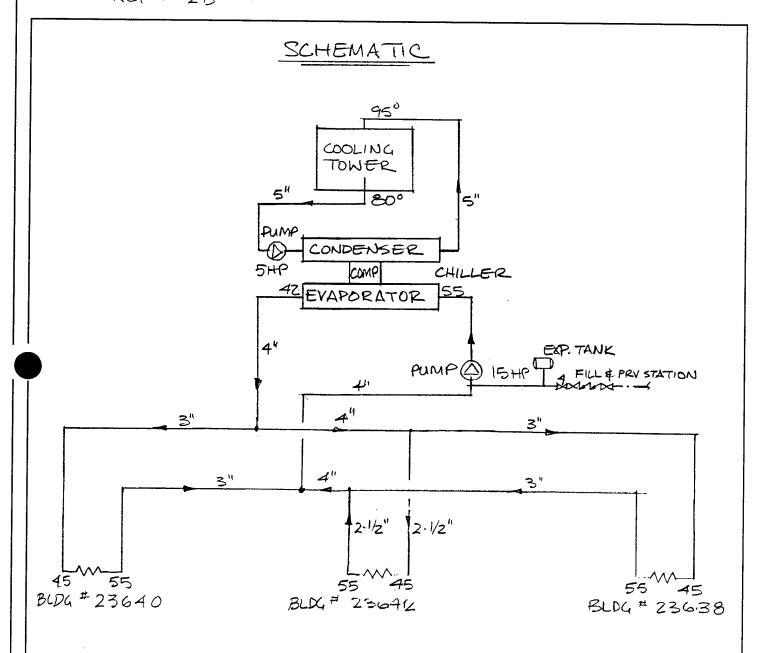
E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

LAUNCH COMPLEX #38

ALT #2B

JOB WEMR ESOS STUDY	#1110,000
SHEET NO.	OF
CALCULATED BY C. BUTIE	-
CHECKED BY	DATE
SCALE	



LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

							•	
		LOCATION: Whit		_	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				MPLEX 38 - CHILLER PI	LANT STUDY - ALT. 2	3	FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/05/92		ECONOMIC LIFE:	25	PREPARED BY:	A. STOVER
1	IN۱	VESTMENT						
	A.	CONSTRUCTION	COST	=			\$367,262	
	8.	SIOH COST		(5.5% of 1A) =			\$20,199	
	C.	DESIGN COST		(6.0% of 1A) =			\$22,036	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$409,497	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D − 1E) =			>	\$409,497
2	EN	IERGY SAVINGS (+)	/COST(-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	4,161	\$26,966	15.23	\$410,695	
	В.	DIST		0	\$0	17.28	\$0	
	C.	PROPANE	\$8.71	0	\$0	19.64	\$0	
	D.	PAPER	*		\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		4,161	26,966.2		>	\$410,695
3	NC	N-ENERGY SAVIN	GS (+) / COST	(-)				
				C. DEMAND SAVINGS) (· =		\$14,253	
		(ANNUAL RECUR		•				
		1 DISCOUNT FAC		•	(From Table A-2) =	14.68		
		2 DISCOUNTED S	SAVINGS (+) / C	COST (-)	(3A x 3A1) =		\$209,234	
	В.	NON-RECURRING	3 (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. EQUIP REPLAC	EMENT COST	\$283,750	1	0.96	\$272,400	
		b. EQUIP REPLACE	CEMENT COST	\$0	5	0.80	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL		\$283,750			\$272,400	
	C.	TOTAL NON-ENE	RGY DISCOU	NTED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =		\$481,634
	D.	PROJECT NON-E	NERGY TEST					
		1 25% MAXIMUM	NON-ENERG	Y CALCULATION		(2F5 x 0.33) =	\$135,529	
		a IF 3D1 => 3C	THEN GO TO 4	•				
		b IF 3D1 < 3C TI	HEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =	1.33	
		c IF 3D1b => 1 7	THEN GO TO 4					
		d IF 3D1b < 1 Th	HEN PROJECT	DOES NOT QUALIFY				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$52,569
5	то	TAL NET DISCOUN	ITED SAVINGS	;		(2F5 + 3C) =		\$892,329
6	DIS	SCOUNTED SAVING	3S-TO-INVES	TMENT RATIO (SIR)		(5/1F) =		2.18
	(II	F SIR < 1 THEN PRO	OJECT DOES I	NOT QUALIFY)				

(1F/4) =

7.79

7 SIMPLE PAYBACK (SPB)

	CONSTRUCTION COST ESTIMATE BREAKDOWN	: BREAKD(NMC				Form Approved Budget Bureau No. 22-R-100	Z-R-100		
CONTRACTOR	эн EMC ENGINEERS INC.			ADDRESS 2750 SOL	JTH WADSW	ОВТН ВЦИ)., #C-200,	ADDITESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227) 80227	
CONTRACT	CONTRACT FOR (Work to be performed) LAUNCH COMPLEX 38 (ALT 2B)						PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BEA		WORK LOCATION WHITE SAN	DS MISSILE	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	LCOST		LABOR COSTS			
Line	Item	Unit of	Quantity			Manhours	Average		Other Direct	Line
Š.	(1)	Measure (2)	ව	G Grit	Total (5)	Mandays (6)	Rate	Total (8)	Costs (9)	Total (10)
	CHILLED WTR GEN, WTR-COOLED 130T (NOM)	EA	-	47100.00	47100	60.00	35.81	2148.6		\$49,248.60
	COOLING TOWER, 228T	EA	-	12000.00	12000	48.00	35.81	1719		\$13,718.88
	PUMP, CENTRIF. 273 GPM, 15 HP	EA	2	2770.00	5540	32.00	35.81	2292		\$7,831.84
	PUMP, CENTRIF. 364 GPM, 5 HP	EA	2	2150.00	4300	24.00	35.81	1719		\$6,018.88
	PIPE, INSULATED CONDUIT, 4"	I.	240	23.50	5640	0.72	35.81	6188		\$11,827.97
	PIPE, INSULATED CONDUIT, 3"	Į,	2260	18.90	42714	0.57	35.81	46130		\$88,844.44
	PIPE, INSULATED CONDUIT, 2-1/2"	FJ	100	16.30	1630	0.47	35.81	1683		\$3,313.07
	TRENCH & BACKFILL, 24"x36"	LUMP SUM	1300 LF	2.81	3653					\$3,653.00
	PAVEMENT, REMOVE & REPLACE	WNS JWN	260 SF	7.00	1820					\$1,820.00
	PIPE, BLK STEEL & FTTGS. 5"	I.F	100	12.58	1258	0.50	35.81	1791		\$3,048.50
	EXPANSION TANK & FILL STA.	ST		455.00	455	5.00	35.81	179	·	\$634.05
	CONCRETE PAD FOR TOWER	LUMP SUM	6 CY	100.00	009					\$600.00
	MISC. STEEL FOR TOWER	LBS	4000	0.75	3000	0.01	35.81	1003		\$4,002.68
	STEEL BUILDING 20'x30'x12'	RUS	600 SF	30.00	18000					\$18,000.00
	-CONTINUED ON NEXT PAGE-									

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NWO				Form Approved Budget Bureau No. 22-R-100	22-R-100		
CONTRACTOR	ы EMC ENGINEERS INC.			ADDRESS 2750 SOL	JTH WADSW	ОВТН ВСИ	J., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	J 80227	
CONTRACT	CONTRACT FOR (Work to be performed) LAUNCH COMPLEX 38 (ALT 2B)						PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WOPK LOCATION WHITE SAN	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
				MATERIAL COST	Lcost		LABOR COSTS			
Line	Item	Cuit of	Quantity			Manhours	Average		Other Direct	Line
Š.	(1)	Measure (2)	(3)	Cnit	Total (5)	Mandays (6)	Rate	Total (8)	Costs	Total (10)
	VALVE, BFLY, CL. 150, 5"	EA	2	115.00	230	4.80	35.81	344		\$573.78
	VALVE, BFLY, CL. 150, 4"	EA	4	90.00	360	3.20	35.81	458		\$818.37
	INTERCONNECT @ EA BLDG.	EA	3	7000.00	21000	280.00	35.81	30080		\$51,080.40
	ETHYLENE GLYCOL	GAL	330	5.90	1947	0.01	35.81	118		\$2,065.17
	SUBTOTAL									\$267,099.63
	OVERHEAD & PROFIT (25%) CONTINGENCY (10%)									\$66,774.91 \$33,387.45
	TOTAL THIS SHEET									\$367,261.99

ESTIMATE SUMMARY

3.1692 3200 74910 2810 600 48500 580 740 550 D 9960 3650 3700 8000 1870 2510 TOTAL DATE: DATE: 3690 850 000 18000 AMOUNT SUB-CONTRACT M Butler # UNIT PRICE 30-2:21 L+ 20 4 500 120C 200 4320 32200 1.80 0521 -0 0 0 571 300 AMOUNT ESTIMATE NO. PREPARED BY: CHECKED BY: SHEET NO. 25-25. 25-25-25. 25 RATE なん アル 252 LABOR TOTAL M.H. 48 44 64 34 288 50 28 48 S O UNIT M.H. 54. .007 44 9 44 \$ 32 5.0 00 1110.000 5640 1630 1260 455 3000 12000 5540 4300 42710 47100 47100 AMOUNT MATERIALS JNIT PRICE 12000 23.50 06.81 16.30 75 2150 12.58 455 # ンナナン 260SF A E O 1300 LF 2260 LI 4000 LBC. EA 240 CF 100 LF QUANTITY 800 S.F. STUDY **4**国 100 (57 1 20 ∢ Į) 38 2.6 N # MIR-COOLED PUMP CENTEIF, 273COM ISHP ALMP, CENTRIF. 364 CPM, 5 HP PAVEMENT, REMOVE & REPLACE 2.1/2" 24" ×36" 'n 4.970,00/0 STEEL BUILDINK, 20'x30'x12 M.033.131.4701 CONCRETTE (2412 FOR TOWER ESOS EXPANSION TANK & FILL STA 2 COMPLEX 7 3 4 M. 151-701200 PIPE, BLK STEEL, +FITCHS. COOLING TOWER 2287 150, CONDUIT DESCRIPTION Ξ = = TREAKH & PACKFILL STEEL SUS CIES BFLY APE INSULATED 307 (NOM) HILLED WTR LAUNCH = = M. 154.940.1070 VALVE MSMR MISC. 5 W.151-851.073U 0/00.011-150.m 07to. 0160. 2.14.2.17.2.21 M. 020,025 * ACCOUNT 5,0 MAIN R. 15-3 R. 15-2 10 PROJECT:

28060

50.00

M = MEANS ESTIMATING

R = RICHARDAN ESTIMATING GUIDE

×

D18-75

470

240 320

25

9.6

4,00

230

90

EA

ż

Ì

1060

27.

N4

52

12.8

3.2

21000

Z

840

280

21000

3000

口口

S

INTERCOUNTET O EA BLDG.

ETHYLENE GLYCOL

M. 157-401-1200

TOWER WATER TREATMENT

80

25

3.3

0.01

1950

5.90

330 GAL

280

42000

2030

303 303 43411# 0 30311301147 , 5-12-32 1 1.23FM 1 SENT DI-HATNES IKANE INPUT FILE NAME : C:\JOBS\EMC\WHITE\RTHA.FRE : WHITE SANDS PROJECT PROJECT : NEW MEXICO -~LOCATION BUILDING OWNER : RCH PROGRAM USER : FOR CHET BUTLER COMMENT EPS FLAG 2-B MOTOR KW SIZE 460 130 VOLTAGE 60 LONG FREQUENCY MAX KW/TONS REFRIGERANT

**** INPUT CONDITIONS ****************************** MACHINE TAG COMPRESSOR SIZE SHELL TYPE DESIGN DUTY DESIGN KW EG 80 42 ENTERING COND TEMP EXITING EVAP TEMP COND FLOW RATE EVAP FLOW RATE 55 95 EXITING COND TEMP ENTERING EVAP TEMP 2 **3** CONDENSER PASSES EVAPORATOR PASSES 0,00025 COND FOULING FACTOR 0.00025 EVAP FOULING FACTOR MAX COND PRESSURE DROP MAX EVAP PRESSURE DROP STD COND TUBE TYPE PUEBLO BUILT BY BRINE TYPE BRINE TYPE EG 30 BRINE % BRINE %

NOTE - RATING OUTSIDE THE SCOPE OF THE ARI CENTRIFUGAL AND ROTARY WATER CHILLERS CERTIFICATION PROGRAM.

42.0 F

130 MODEL RTHA LONG SHELL LENGTH 121 TONS DESIGN DUTY 95 KW POWER CONSUMED 0.79 KW PER DESIGN DUTY

EXIT EVAP TEMP

COND TUBE TYPE

245 GPM EVAP FLOW RATE 55.0 F ENTERING EVAP TEMP 3 EVAPORATOR PASSES EVAP PRESSURE OROP 16 FEET EVAP FOULING FACTOR 0.00025 EVAP BRINE TYPE EG EVAP BRINE PERCENT

30 EVAP BRINE FREEZE PT 5.1 F 80.0 F ENTERING COND TEMP

237 GPM 145. COND FLOW RATE EXIT COND TEMP 95.0 F CONDENSER PASSES 2 COND PRESSURE DROP 9 FEET 0.00025 COND FOULING FACTOR COND BRINE TYPE WATER COND BRINE PERCENT 0 STANDARD

NOMINAL MOTOR KW 107 KW MAX LRA AT NOMINAL MOTOR KW 658 AMPS RLA AT MOTOR KW 151 AMPS RLA AT SELECTION KW 133 AMPS

SHIP WEIGHT 5857 LBS D18-76 OPERATING WEIGHT 6920 LBS

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • Germany

LAUNCH COMPLEX #38 ALT # 28

JOB WILMR ESOS STUDY	# 1110,000
SHEET NO.	OF
CALCULATED BY C. Butler	DATE 3.9.92
CHECKED BY	
•	DATE
SCALE	

ALT. # 2B NATER-COOLED CONTRIFUCAL. SERVING 23640, 23642 \$ 23638

A. EVAPORATOR :

USING APPLICABLE DATA FROM ALT. # 2A:

GPM: 273 (30% B9 NT, CLYCOL SOLN.)

HEAD: 106 | W.C.

MOTORHP: 15

CAPY: 121.3 TON R. (ADJ. FOR GLYCOL, FOLLING FACTOR & ALT.)

B. CONDENSER:

GPM: 121.3 TON x 3.0 GPM/TON = 364 GPM

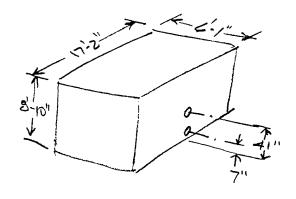
HEAD:

STATIC HD = 10' (EST, SEE BELOW)

P.D. SPRAY HDS = 0°

PUMP HP = 1.2 × 364 × 30/3960 × 0.7 = 4.7 SAY 5 HP.

C. COOLING TOWER SELECTION: (SEE ATTACHED BAC SELECTION SHEETS).



MOD. 3130 Nº9000 W/ PRT.

\$ 12000 W/FRT.

POTR MODEL

JE-130

TOTAL CORR RES.

S.S. FRAME

FRENCHAS.

ELSCWIFERE

WITH SHP FAN NOTOR.

	JOB	
E M C ENGINEERS, INC.	SHEET NO OF	
Denver • Colorado Springs • Atlanta • Germany	CALCULATED BY DATE	
	CHECKED BY DATE	
	SCALE	

D. CHILLER SELECTION

REOD CAPACITY! 120 T. (APPROX. ADI, POR ,00025 EF, & 30% GLYCOL.)

LVG WTR TEMP: 42 F WTR TEMP RISE 13 F

ENT COND WTR TEMP 80 F

COND. WTR FLAW 360 GPM

POULING FACTUR 0,00025

POWER 460/3/60

USE A TRANE MODEL RTHA 130 - 2 PASS W/STD EVAP & COND SHELL.

SERIES 3000 CAPACITY TABLES



THERMAL PERFORMANCE CERTIFIED BY THE COOLING TOWER INSTITUTE (CTI) IN ACCORDANCE WITH CTI STANDARD STD-201

TABLE 1—SINGLE CELL SELECTIONS

MODEL								SEL	ECTIO	N FACT	OR							
NUMBER	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0
3130	N.A.	217	234	251	270	291	313	337	362	390	420	451	486	523	562	605	651	701
3150	234	251	270	291	313	336	362	389	418	450	484	521	560	602	648	697	749	806
3165	257	277	298	320	344	370	398	428	460	495	532	572	616	662	712	766	823	885
3184	289	311	334	360	387	416	447	480	516	555	597	641	690	741	797	857	921	990
3185	290	311	335	360	387	416	447	480	516	555	597	641	689	741	796	856	920	989
3205	322	346	372	400	429	461	496	533	572	615	661	710	763	820	881	947	1017	1093
3213	335	360	387	415	446	480	515	554	595	639	687	738	793	851	915	983	1056	1135
3235	371	398	428	459	493	530	569	611	656	705	757	813	874	938	1008	1082	1162	1249
3269	426	457	491	527	566	608	652	700	752	807	866	930	998	1072	1151	1235	1326	1424
3294	467	501	538	577	620	665	714	766	822	882	947	1016	1090	1170	1256	1347	1446	1552
3315	502	538	577	620	665	713	765	821	881	945	1014	1088	1167	1252	1343	1441	1546	1659
3341	546	585	627	673	722	774	830	890	954	1023	1097	1176	1261	1353	1450	1555	1668	1788
3373	599	642	688	738	791	848	909	974	1044	1119	1199	1286	1378	1477	1583	1697	1819	1950
3400	644	690	740	793	849	910	975	1045	1120	1200	1286	1378	1477	1582	1695	1817	1947	2086
3424	684	733	786	842	901	966	1035	1108	1187	1272	1363	1460	1564	1675	1795	1923	2060	2207
3427	684	733	786	843	904	969	1039	1114	1195	1281	1374	1473	1579	1693	1816	1947	2087	2238
3458	736	788	845	906	971	1041	1116	1196	1282	1374	1473	1579	1692	1814	1944	2084	2234	2395
3485	781	837	896	961	1030	1103	1182	1267	1358	1455	1559	1671	1791	1919	2056	2204	2361	2531
3514	832	891	954	1022	1094	1172	1255	1344	1440	1542	1651	1769	1894	2029	2173	2327	2492	2669
3560	910	974	1042	1116	1195	1279	1369	1466	1569	1680	1799	1925	2061	2207	2362	2529	2707	2898
3586	909	984	1063	1147	1236	1330	1429	1533	1643	1758	1879	2005	2136	2274	2416	2564	2718	2876
3642	1001	1082	1169	1260	1357	1460	1568	1681	1801	1926	2057	2194	2337	2486	2640	2800	2966	3137
3685	1072	1158	1251	1348	1451	1560	1675	1795	1922	2055	2194	2339	2490	2648	2811	2981	3156	3337
3707	1063	1157	1256	1361	1472	1590	1713	1843	1979	2121	2269	2423	2583	2748	2918	3094	3273	3457
3758	1145	1245	1351	1463	1582	1708	1839	1978	2123	2274	2432	2595	2765	2940	3121	3307	3497	3691
3803	1218	1324	1436	1554	1680	1812	1951	2097	2250	2409	2575	2747	2925	3109	3299	3494	3693	N.A.
3813	1178	1289	1407	1533	1665	1806	1953	2108	2270	2439	2614	2796	2983	3175	3372	3573	N.A.	N.A.
3860	1251	1368	1493	1626	1766	1914	2069	2232	2403	2580	2764	2954	3151	3352	3558	N.A.	N.A.	N.A.
3935	1369	1496	1632	1775	1927	2087	2255	2431	2614	2805	3003	3207	3418	3634	3855	4080	4308	N.A.
3990	1456	1591	1734	1885	2046	2214	2391	2576	2769	2970	3178	3393	3613	3840	4071	4306	N.A.	N.A.
31055	1560	1703	1855	2016	2186	2365	2553	2749	2953	3165	3385	3611	3844	4082	4326	N.A.	N.A.	N.A.



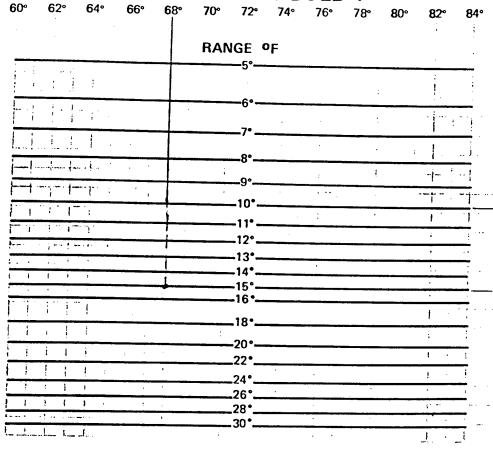
MODEL	1		tac,			\$400 ¥	e LOT	製 SEI	ECTIO	N FACT	OR 🏋	为为		140 mg	数符度	Z 5=		Se Se
NUMBER	0.5	″1.0 ↑	€1.5	2.0	2.5	ે 3.0 ે	- 3.5 ^{-/2}	- 4.0 °	4.5	₹ 5.0 %	₹ 5.5 💯	· 6.0 €	* 6.5 ÷	≈7.0 🖫	ै 7.5 ♥	₹8.0	₹ 8.5	€9.0 €
3130-2	N.A.	434	468	502	540	582	626	674	724	780	840	902	972	1046	1124	1210	1302	1402
3150-2	468	502	540	582	626	672	724	778	836	900	968	1042	1120	1204	1296	1394	1498	1612
3165-2	514	554	596	640	688	740	796	856	920	990	1064	1144	1232	1324	1424	1532	1646	1770
3184-2	578	622	668	720	774	832	894	960	1032	1110	1194	1282	1380	1482	1594	1714	1842	1980
3185-2	580	622	670	720	774	832	894	960	1032	1110	1194	1282	1378	1482	1592	1712	1840	1978
3205-2	644	692	744	800	858	922	992	1066	1144	1230	1322	1420	1526	1640	1762	1894	2034	2186
3213-2	670	720	774	830	892	960	1030	1108	1190	1278	1374	1476	1586	1702	1830	1966	2112	2270
3235-2	742	796	856	918	986	1060	1138	1222	1312	1410	1514	1626	1748	1876	2016	2164	2324	2498
3269-2	852	914	982	1054	1132	1216	1304	1400	1504	1614	1732	1860	1996	2144	2302	2470	2652	2848
3294-2	934	1002	1076	1154	1240	1330	1428	1532	1644	1764	1894	2032	2180	2340	2512	2694	2892	3104
3315-2	1004	1076	1154	1240	1330	1426	1530	1642	1762	1890	2028	2176	2334	2504	2686	2882	3092	3318
3341-2	1092	1170	1254	1346	1444	1548	1660	1780	1908	2046	2194	2352	2522	2706	2900	3110	3336	3576
3373-2	1198	1284	1376	1476	1582	1696	1818	1948	2088	2238	2398	2572	2756	2954	3166	3394	3638	3900
3400-2	1288	1380	1480	1586	1698	1820	1950	2090	2240	2400	2572	2756	2954	3164	3390	3634	3894	4172
3424-2	1368	1466	1572	1684	1802	1932	2070	2216	2374	2544	2726	2920	3128	3350	3590	3846	4120	4414
3427-2	1368	1466	1572	1686	1808	1938	2078	2228	2390	2562	2748	2946	3158	3386	3632	3894	4174	4476
3458-2	1472	1576	1690	1812	1942	2082	2232	2392	2564	2748	2946	3158	3384	3628	3888	4168	4468	4790
3485-2	1562	1674	1792	1922	2060	2206	2364	2534	2716	2910	3118	3342	3582	3838	4112	4408	4722	5062
3514-2	1664	1782	1908	2044	2188	2344	2510	2688	2880	3084	3302	3538	3788	4058	4346	4654	4984	5338
3560-2	1820	1948	2084	2232	2390	2558	2738	2932	3138	3360	3598	3850	4122	4414	4724	5058	5414	5796
3586-2	1818	1968	2126	2294	2472	2660	2858	3066	3286	3516	3758	4010	4272	4548	4832	5128	5436	5752
3642-2	2002	2164	2338	2520	2714	2920	3136	3362	3602	3852	4114	4388	4674	4972	5280	5600	5932	6274
3685-2	2144	2316	2502	2696	2902	3120	3350	3590	3844	4110	4388	4678	4980	5296	5622	5962	6312	6674
3707-2	2126	2314	2512	2722	2944	3180	3426	3686	3958	4242	4538	4846	5166	5496	5836	6188	6546	6914
3758-2	2290	2490	2702	2926	3164	3416	3678	3956	4246	4548	4864	5190	5530	5880	6242	6614	6994	7382
3803-2	2436	2648	2872	3108	3360	3624	3902	4194	4500	4818	5150	5494	5850	6218	6598	6988	7386	N.A.
3813-2	2356	2578	2814	3066	3330	3612	3906	4216	4540	4878	5228	5592	5966	6350	6744	7146	N.A.	N.A.
3860-2	2502	2736	2986	3252	3532	3828	4138	4464	4806	5160	5528	5908	6302	6704	7116	N.A.	N.A.	N.A.
3935-2	2738	2992	3264	3550	3854	4174	4510	4862	5228	5610	6006	6414	6836	7268	7710	8160	8616	N.A.
3990-2	2912	3182	3468	3770	4092	4428	4782	5152	5538	5940	6356	6786	7226	7680	8142	8612	N.A.	N.A.
31055-2	3120	3406	3710	4032	4372	4730	5106	5498	5906	6330	6770	7222	7688	8164	8652	N.A.	N.A.	N.A.



D18-80

SERIES 3000 SELECTION CHART

ENTERING WET BULB °F



STEP-BY-STEP PROCEDURE FOR SELECTING A SERIES 3000 COOLING TOWER

GPM 360 Water In 95 °F Water Out 85 °F Wet Bulb 68 °F (80) (15)

1. Determine Range: Water In 95 °F - Water Out 85 °F = 10 °F = Rang

2. Determine Approach: Water Out 85 °F - Water Bulb 68 °F = 17

3. Determine Selection Factor

Entering at the design Wet Bulb temperature, project a line vertically downward to intersect the Range determined above. From this point project a horizontal line to the right intersecting the Approach curve at that temperature determined above. Then project a line vertically downward to intersect the design Wet Bulb line. Read the Selection Factor at this point.

Selection Factor = 8.5 4. Select Unit (4.5)

Turn to the Series 3000 Capacity Tables on page 10 which tabulate the tower capacities in USGPM for Selection Factors ranging from 0.50 to 9.00. To select a tower, enter the table and read across the Selection Factor line to a factor EQUAL TO OR JUST LESS THAN the factor determined in Step 3. Read down the column until reaching a flow rate EQUAL TO OR GREATER THAN the design flow. Read the tower model number from the column on the left. If desired, the exact flow capacity can be found by interpolating directly between listed selection factors.

If the required flow rate exceeds all values shown in Table 1 (single cell units) for the appropriate Selection Factor, repeat the procedure using Table 2 (Double Cell units). Selection of three or more cells can be obtained by dividing the required flow rate by the number of cells required and utilizing Table 1.

FINAL SELECTION IS MODEL 3130

SELECTION FACTORS

SELECTION FACTORS

3.0

3.0

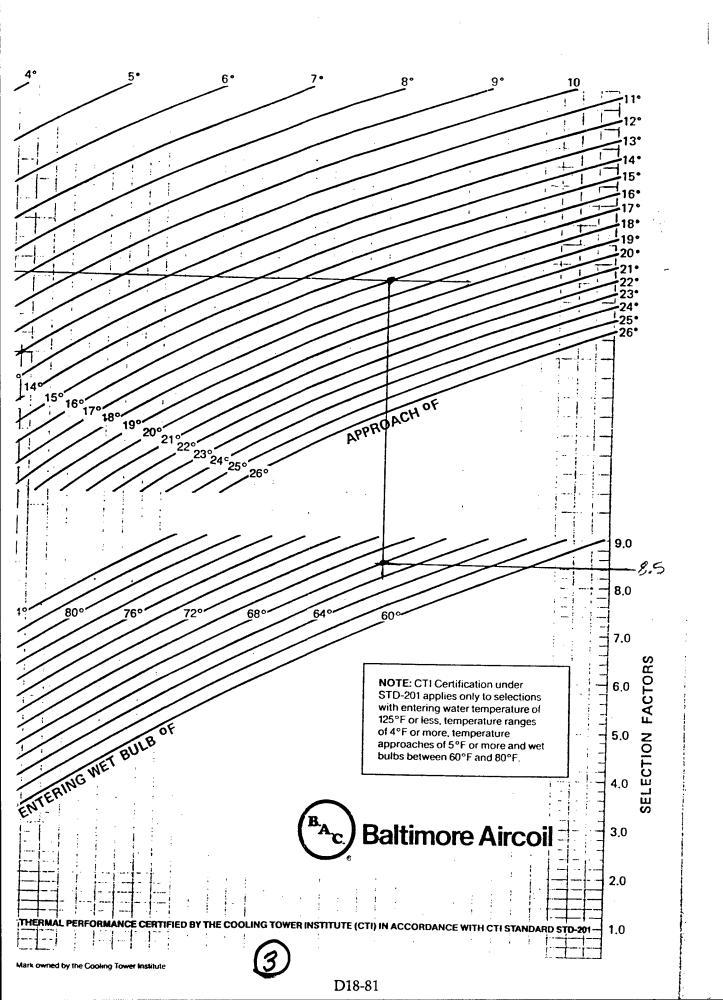
3.0

3.0

9.0



80° 82° 84° APPROACHOR 1 13° í 16° 18° 19° 20°, 219 ^{23°}24°25° 9.0 3 8.0 °F = Range 7.0 SELECTION FACTORS 6.0 ect the Range ne Approach intersect the 5.0 4.5 4.0 s in USGPM id across the ed in Step 3. 3.0 design flow. acity can be appropriate aree or more and utilizing 2.0 ORMANCE CERTIFIED BY THE COOLING TOWER INSTITUTE (* Mark owned by the Cooling Tower Institute D18



Selection Procedure

Given:		Selection Summary:	
Required Capacity	200 tons	Model	RTHA 215
Leaving Chilled		Capacity	200 Tons
Water Temperature	45 F	Power Input	148 Kw
Chilled Water Temperature	Drop 12 F	Entering/Leaving Chilled	
Entering Condenser		Water Temperature	57/45 F
Water Temperature	85 F	Evaporator Flow	400 GPM
Condenser Water Flow	600 GPM	Evaporator Pressure Drop	11 Feet
Condenser/Evaporator		Entering Condenser	
Fouling Factor	0.00025	Water Temperature	85 F
Supply Voltage	460/60/3	Condenser Water Flow	600 GPM
1		Condenser Pressure Drop	14 Feet
From Table 14-1 on page 14	4, an RTHA	Condenser/Evaporator	
215 with standard length sl	nells, 3 pass	Fouling Factor	.00025
evaporator and 2 pass cond		Supply Voltage	460/60/3
given conditions will produ	ce 200 tons	Rated Load Amps	206 Amps
at 148 Kw (.74 Kw/ton × 2)	00 tons).	·	•

Evaporator GPM and pressure drop can be determined as follows:
$GPM = \frac{Tons \times 24}{}$
Chilled Water ΔT
$\frac{200 \times 24}{12} = 400 \text{ Gpm}$
Evaporator pressure drop for 400 GPM
from Chart 17-1 on page 17 is 11 feet - of water.
Condenser processed drop for 600 CDM
Condenser pressure drop for 600 GPM from Chart 17-3 on page 17 is 14 feet

of water.



Performance Data

RTHA 130 — RTHA 150



Capacity	Standard	Long
Tons	Shell	Shell
	GRTHA 130 Std9	RTHA 130 Long
5325 P	.77 Kw/Ton	.72 Kw/Ton
	11' EPD; 15' CPD	14' EPD; 19' CPD
	RTHA 150 5~4	RTHA 150 Long
150	.74 Kw/Ton	.69 Kw/Ton
	13' EPD; 17' CPD	16' EPD; 21' CPD

Notes:

- Performance is based on three-pass evaporator and two-pass condenser, .00025 Fouling Factor in the evaporator and condenser based on ARI Standard 550-90, 45 F evaporator water (2.0 gpm/ton), 85 F entering condenser water (3.0 gpm/ton).
- The selections are representative. Chiller selections can be optimized through the use of the Series R[®] CenTraVac[®] selection program available through the local Trane Sales Office.
- 3. EPD = evaporator pressure drop; CPD = condenser pressure drop.

Table 10-2 — Well Water Performance Examples

Capacity	Standard	Long
Tons	Shell	Shell
	RTHA 130 Std	RTHA 130 Long
125	.51 Kw/Ton	.47 Kw/Ton
	11' EPD; 16' CPD	14' EPD; 21' CPD
	RTHA 150 Std	RTHA 150 Long
150	.50 Kw/Ton	.46 Kw/Ton
	13' EPD; 18' CPD	16' EPD; 22' CPD

Notes:

- Performance is based on three-pass evaporator and two-pass condenser, .00025 fouling factor in the evaporator and condenser based on ARI Standard 550-90, 44 F evaporator water (2.0 gpm/ton), 65 F entering condenser water (3.0 gpm/ton).
- The selections are representative. Chiller selections can be optimized through the use of the Series R CenTraVac selection program available through the local Trane Sales Office.
- 3. EPD = evaporator pressure drop; CPD = condenser pressure drop.



Dimensions

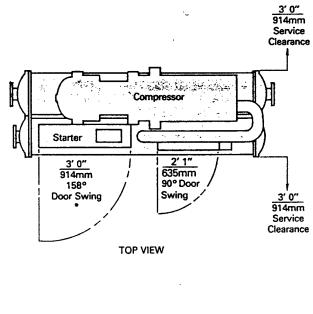
RTHA 130 — RTHA 150

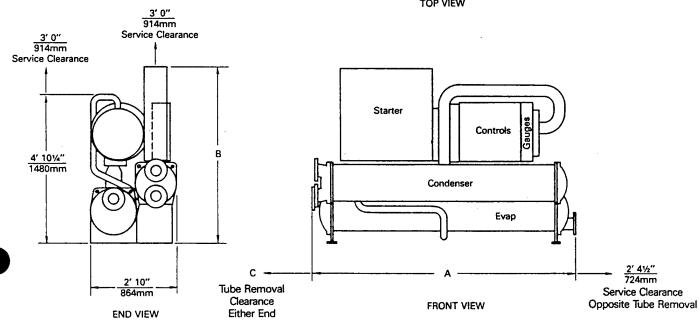
		English Dimensions		
Unit	Starter	Α	В	С
130/150 Ton Std.	460/575V	8' 10%"	5′ 9½″	7' 0½"
130/150 Ton Std.	200/230V	8′ 10%″	6′ 2½″	7′ 0½"
130/150 Ton Long	460/575V	11′ 47⁄6″	5′ 9½″	9′ 6½″
130/150 Ton Long	200/230V	11' 4%"	6′ 2½″	9′ 6¼″

				The same of the sa
	C.	Metric Dimensions	-	
Unit	Starter	A	В	С
130/150 Ton Std.	460/575V	Z/Tomm	1765mm	2146mm
130/150 Ton Std.	200/230V	2715mm	1892mm	2146mm
130/150 Ton Long	460/575V	3477mm	1765mm	2908mm
139/450 Ion Long	200/230V	3477mm	1892mm	29087177

*460/575V Starter Shown: 200/230V Starter Has Two Doors (2" - 55%" and 1" - 15%)" (Total Width is 3" - 8").

52mm 346mm 1118mm

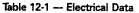




D18-85

General Data

RTHA 130 — RTHA 150



		Nominal Voltage	200	230	460	575
Model	Nominal Motor Rating (Kw)	Voltage Utilization Range	180/220	207/253	414/506	518/632
		RLA	348	302	151	121
RTHA 130	107	MCA	435	378	189	151
		LRA	1502	1316	658	544
		RLA	390	339	170	136
RTHA 150	121	MCA	488	424	213	170
		LRA	1846	1555	803	630

MCA = Minimum Circuit Ampacity is 125% of the compressor RLA per NEC 440-32 and 440-33. LRA = Locked Rotor Amps.

Table 12-2 - General Data

		RTHA	130	RTHA	150
		Standard Shell	Long Shell	 Standard Shell 	Long Shel
Refrigerant Type		R-22	R-22	R-22	R-22
Refrigerant Charge	(lp)	255	285	255	285
nelligerant Clarge	(kg)	116	129	116	129
Oil Charge	(gal)	4.4	4.4	4.4	4.4
Oil Clarge	(L)	16.7	16.7	16.7	16.7
Operating Weight	(lb)	5690	6920	5690	6290
Operating weight	(kg)	2581	2853	2581	2853
Skinning Woight	(lb)	5351	5857	5351	5857
Shipping Weight	(kg)	2428	2656	2428	2656



					RTH	A 130							RTH	A 150			
₹			Standa	rd Shell			Long	Shell			Standa	rd Shell			Long	Shell	
		1	2	3	4	1	2	3	4	1	2 3 4 1 2			3	4		
		Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Storage Capacity	(gal)	17	17	17	17	22	22	22	22	19	19	19	19	25	25	25	25 25
Storage Capacity	(L)	64	64	64	64	83	83	83	83	72	72	72	72	95	95	95	95
Minimum Flow Rate	(GPM)	376	188	125	94	376	188	125	94	430	215	143	107	430	215	143	107
within riow rate	(L/s)	24	12	8	6	24	12	8	6	27	14	9	7	27	14	9	7
Maximum Flow Rate	(GPM)	1374	687	458	344	1374	687	458	344	1576	788	525	394	1576	788	525	394
maximum row hate	(L/s)	87	43	29	22	87	43	29	22	99	50	33	25	99	50	33	25
Connection Size	(IN)	6	4	4	4	6	4	4	4	6	4	4	4	6	4	4	4

Table 12-4 — Condenser Data

		RTHA	130	RTHA	150	
		Standard Shell	Long Shell	Standard Shell	Long Shel	
		2 Pass	2 Pass	2 Pass	2 Pass	
Storage Capacity	(gal)	13	17	15	20	
Storage Capacity	(L)	49	64	57	76	
Minimum Flow Rate	(GPM)	149	149	173	173	
wilnimum Flow Rate	(L/s)	9	9	11	11	
Maximum Flow Rate	(GPM)	545	545	636	636	
maximum row hate	(L/s)	34	34	40	40	
Connection Size	(IN)	4	4	4	4	



^{1.} RLA = Rated Load Amps.

In all cases, the motor to be furnished must have a KW rating equal to or greater than the full load KW determined from the cataloged data or the Series R[®] CenTraVac[®] Computer Selection Program.

Water Pressure Drop Data

RTHA 130 — RTHA 150

Chart 13-1 - Standard Length Evaporators

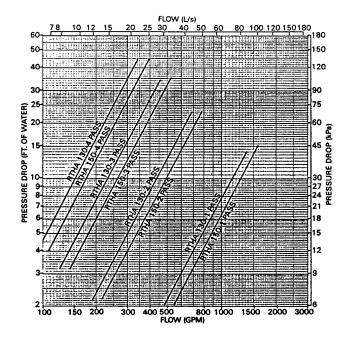


Chart 13-2 - Long Length Evaporators

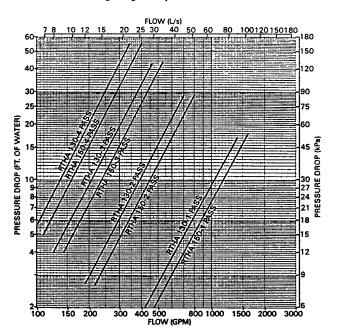


Chart 13-3 — Standard Length Condensers

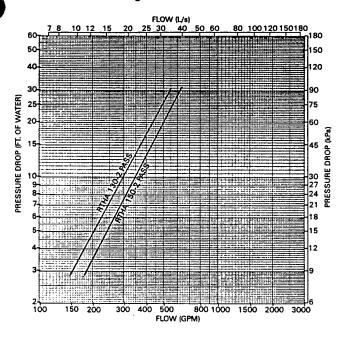
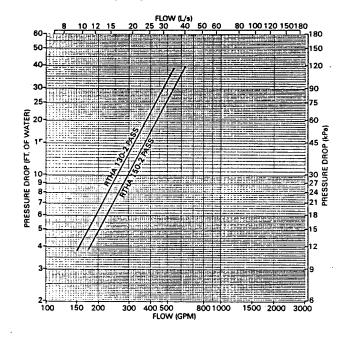


Chart 13-4 — Long Length Condensers





LC-38 ALT ZB MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

MONTHLY	ENERGY	CONSUMPTION

	ELEC	DEMAND	GAS		GAS DMND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(kWh)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)
Jan	55,705	152	1,318	30	2
Feb	50,270	153	982	27	1
March	57,098	158	250	28	0
April	56,808	170	0	37	0
May	70,276	193	0	111	0
June	77,630	212	0	163	0
July	82,872	219	0	189	0
Aug	83,622	212	0	176	0
Sept	70,733	192	0	108	0
Oct	61,932	169	4	38	0
Nov	53,358	155	484	28	1
Dec	54,891	153	1,060	30	1
Total	775,196	219	4,098	965	2

Building Energy Consumption = 56,409 (Btu/Sq Ft/Year) Source Energy Consumption = 154,509 (Btu/Sq Ft/Year)

Floor Area =

54,167 (Sq Ft)

2 monthly KW FOR CHILLER PLANT = 649,2

P 24072 111.5

ALT ZB 811.1

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

------EQUIPMENT ENERGY CONSUMPTION -------

	Equip		e . t					sumption		A	A-+	M	N	* - 4 × •
um	Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	0ct	Nov	Dec	Tota
0	LIGHTS													
	ELEC	18033	16350	19493	17327	18763	18689	17401	19493	17327	18763	17130	17401	216,17
	PK	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7	86.7
1	MISC LD													
	ELEC	16519	14933	16813	15960	16666	16235	16391	16813	15960	16666	15923	16391	195,27
	PK	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7
2	MISC LD													
	GAS	1318	982	250	0	0	0	0	0	0	4	484	1060	4,098
	PK	1.8	1.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.4	1.8
3	MISC LD													
	OIL	0	0	0	0	0	0	0	0	0	0	0	0	(
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	MISC LD													
	P STEAM	0	. 0	0	0	0	0 '	0	Ó	0	0	0	0	(
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	MISC LD													
	P HOTH20	0	0	0	0	0	0	0	0	0	0	0	0	ı
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	MISC LD													
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0	(
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	EQ1500		TRAI	NE SERIES	S R CTV :	>200 TON:	s							
	ELEC	9308	8289	8948	9862	17460	23713	29453	27690	18453	10118	8843	9254	181,39
	PK	15.6	17.2	20.7	28.1	46.4	64.8	72.2	64.9	45.7	27.5	18.3	16.5	437.4 72.
1	EQ5100		COOL	LING TOW	E R									
	ELEC	0	0	0	2196	5542	7530	7782	7782	7530	4539	0	0	42,90
	PK	0.0	0.0	0.6	10.5	10.5	10.5	10.5	10.5	10.5	10.5	0.0	0.0	74.1
1	EQ5100		COOL	LING TOW										
	WATER	30	27	28	37	111	163	189	176	108	38	28	30	96
	PK	0.1	0.1	0.1	0.2	0.4	0.4	0.5	0.4	0.3	0.2	0.1	0.1	0.!
1	EQ5001			LLED WATE										
	ELEC	8325	7520	8325	8057	8325	8057	8325	8325	8057	8325	8057	8325	98,02
	PK	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	134.4 11.
1	EQ5010			DENSER W										
	ELEC	2775	2507	2775	2686	2775	2686	2775	2775	2686	2775	2686	2775	32,67
	PK	3.7	3.7	3.7	3.7	3.7		D18 ³ -90	3.7	3.7	3.7	3.7	3.7	

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

V 600

PAGE 3

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

Chiller Controls

ELEC 744 672 744 720 744 720 744 744 720 744 720 744 8,760 V PK 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 12 1.0

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

------ UTILITY PEAK CHECKSUMS-----

Utility ELECTRIC DEMAND

Peak Value 219.0 (kW)

Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16	Month 7				
Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)	
Cooling E	Equipment				
1	EQ1500	TRANE SERIES R CTV >200 TONS	98.6	45.03	
Sub Total	ι		98.6	45.03	
Sub Total	ı		0.0	0.00	
Sub Total	ι		0.0	0.00	
Sub Total	l		0.0	0.00	
Miscellar	neous				
Lights			86.7	39.58	
Base Uti	ilities		0.0	0.00	
Misc Equ	•		33.7	15.39	
Sub Total			120.4	54.97	
Grand Tot	tal		219.0	100.00	

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION: White	e Sands Missil	le Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:		- ECO'S			FISCAL YEAR:	1992
		DISCRETE PORTI		TOTAL				
		ANALYSIS DATE:	06/11/92		ECONOMIC LIFE:	15	PREPARED BY:	A. STOVER
1	IN۱	/ESTMENT						
	A.	CONSTRUCTION	COST	=			\$15,025	
	В.	SIOH COST		(5.5% of 1A) =			\$826	
	C.	DESIGN COST		(6.0% of 1A) =			\$902	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$16,753	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$16,753
_								
2	EN	ERGY SAVINGS (+)						
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
		ELEC	\$6.48	876	\$ 5,670	10.79	\$61,178	
		DIST		0	\$0	11.57	\$0	
		PROPANE	\$6.71	189	\$1,268	12.38	\$15,700	
		PAPER		0	\$0		\$0	
		COAL			\$0	11.35	\$0	
	F.	TOTAL		1,065	6,938.1		 >	\$76,878
3	NO	N-ENERGY SAVIN	GS (+) / COST	(-)				
				C. DEMAND SAVINGS)	=		\$8,756	
		1 DISCOUNT FAC		ŕ	(From Table A-2) =	10.67	40,00	
		2 DISCOUNTED S	AVINGS (+) / C	OST (-)	(3A x 3A1) =		\$93,421	
	В.	NON-RECURRING	i (+/–)		,		¥,· - -	
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a.		\$0		0.00	\$0	
		b.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0	
		d TOTAL	•	\$0			\$0	
	C.	TOTAL NON-ENE	RGY DISCOUN	ITED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$ 93,421
	D.	PROJECT NON-E	NERGY TEST					V,
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$25,370	
		a IF 3D1 => 3C T	HEN GO TO 4	:		•		
		b IF 3D1 < 3C TH	IEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =	6.10	
		c IF 3D1b => 1 T	HEN GO TO 4			•	•	
		d IF 3D1b < 1 TH	EN PROJECT	DOES NOT QUALIFY				
4	FIR	ST YEAR DOLLAR	SAVINGS (1) /	COSTS (-)	/050	. 04 . (004-1/05)		A
		TAL NET DISCOUN			(2F3	+ 3A + (3B1d/25)) =		\$15,694
				MENT RATIO (SIR)		(2F5 + 3C) =		\$170,300
•		SIR < 1 THEN PRO				(5/1F) =		10.17
7		IPLE PAYBACK (SPI		IOT QUALIFT)		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
•	-119	= : > (35)	- ,			(1F/4) =		1.07

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NWC							
CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SOI	JTH WADSW	ORTH BLVI	D., #C-200,	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO	D 80227	
CONTRACT	CONTRACT FOR (Work to be performed) ECO'S - BLDG, 23640						PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	WORKLOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	RANGE, NE	W MEXICO
				MATERIAL COST	LCOST		LABOR COSTS			
Line	Item	of Chit	Quantity			Manhours	Average		Other Direct	Line
V	(£)	Measure (2)	<u>ත</u>	(4)	Total (5)	Mandays (6)	Rate	Total (8)	Costs (9)	Total (10)
-	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS								,	
	4 FT. ENERGY EFFICIENT LAMPS	EA	374	2.19	819.06	0.09	27.60	908.37		\$1,727.43
	ENERGY EFFICIENT BALLASTS	EA	189	14.06	2657.34	0.85	27.60	4439.16		\$7,096.50
2	INSTALL DRY-BULB ECONOMIZER ON AHU									,
D10	MIXED, RETURN, & OUTSIDE AIR SENSORS	EA	က	147.50	442.50	0.67	35.81	71.66		\$514.16
	RECEIVER CONTROLLER W/ FIELD TEST	EA	-	235.00	235.00	10.00	35.81	358.10		\$593.10
	LOW-LEAKAGE DAMPER	EA	2	217.00	434.00	6.00	27.63	331.56		\$765.56
	PNEUMATIC ACCUATOR	EA	2	226.00	452.00	1.00	27.63	55.26		\$507.26
	PNEUMATIC TUBING	ħ	150	0.70	105.00	0.09	27.63	377.15		\$482.15
3	CHILLED WATER RESET ON WTR-CLD CHILLER	EA	-	325.00	325.00	12.00	27.60	331.20		\$656.20
4	REPLACE 40 HP FAN MTR W/ HI EFF-7.5 HP MTR	Ē	-	716.00	716.00	7.24	27.60	199.82		\$915.82
5	RESHEAVE FAN - AHU #1	Æ	-	345.00	345.00	345.00 Includes material & labor	erial & labor			\$345.00
9	INSTALL CHILLED WATER COIL - AHU #2	Œ	-	1146.0	1146.00	10.00	27.60	276.00		\$1,422.00
	TOTAL THIS SHEET									\$15,025.18
Source: Ligh	Source: Lightbulb Supply Co., Denver, CO; Baldor Motors and Drives Cat Nov. 1991; Means Electrical & Mechanical Cost Data, 1992; Material prices include 25% overhead & profit; Labor Source: U.S. Dept. of Labor, General Wage Decision	ans Electrical & M	lechanical Coet D	ata, 1992; Materi	al prices include 25%	overhead & profit; I	abor Source: U.S. D	ept. of Labor, Genera	al Wage Decision	

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

								•
		LOCATION: White			REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	BLDG. 23642	- ECO'S			FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL				
		ANALYSIS DATE:	06/29/92		ECONOMIC LIFE:	15	PREPARED BY:	A. NIEMEYER
1	INV	VESTMENT						
·		CONSTRUCTION	COST	=			\$24,053	
	В.			(5.5% of 1A) =			\$1,323	
	C.	DESIGN COST		(6.0% of 1A) =			\$1,443	
	D.			(1A + 1B + 1C) =			\$26,819	
	E.	SALVAGE VALUE					\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$26,819
								. ,
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	184	\$1,193	10.79	\$12,877	
	В.	DIST		0	\$0	11.57	\$0	
	C.	PROPANE	\$6.71	(13)	(\$90)	12.38	(\$1,113)	
		PAPER		0	\$0		\$0	
	E.	COAL			\$0	11.35	\$0	
	F.	TOTAL		171	1,103.5		>	\$11,763
2	NO	M ENERGY CAVIN	CC (A) LOOST	<i>(</i>)				
3		N-ENERGY SAVIN					•	
	Λ.	1 DISCOUNT FAC		C. DEMAND SAVINGS)	/C T.b.(- A. 0)		\$5,187	
		2 DISCOUNTED S		·OST (-)	(From Table A-2) =	10.67	A 75 A 45	
	R	NON-RECURRING		031 (-)	(3A x 3A1) ≖		\$55,345	
	.	ITEM	4 (++-)		VEAROE	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	YEAR OF OCCURRENCE (2)	DISCOUNT	DISCOUNTED	
		a.		\$0	OCCORNENCE (2)	FACTOR (3)	SAVINGS (4)	
		ь.		\$0		0.00	\$0	
		c.		\$0		0.00	\$0 \$0	
		d TOTAL		\$0		0.00	\$0	
	C.		RGY DISCOUN	ITED SAVINGS (+) / COS	ST (-)	(3A2 + 3Bd4) =	40	\$55,345
		PROJECT NON-E				(5,2 : 5224) =		455,545
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	\$3,882	
		a IF 3D1 => 3C T	THEN GO TO 4			,	, -,	
		b IF 3D1 < 3C TH	IEN CALCULA	TE SIR		(2F5 + 3D1) / 1F =	0.58	
		c IF 3D1b => 1 T	HEN GO TO 4					
		d IF 3D1b < 1 Th	IEN PROJECT	DOES NOT QUALIFY				
_								
		RST YEAR DOLLAR			(2F3 ·	+ 3A + (3B1d/25)) =		\$6,290
		TAL NET DISCOUN				(2F5 + 3C) =		\$67,109
6				MENT RATIO (SIR)		(5/1F) =		2.50
7		SIR < 1 THEN PRO		IOT QUALIFY)				
′	SIN	MPLE PAYBACK (SP	D)			(1F/4) =		4.26

Commontant		CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKD	NMC				Form Approved			
CONTINUED HEEMS IN C. CONT								Budget Bureau No	. 22-F-100		
CONTINUE TO INTERFERENCE	CONTRACTC				ADDRESS 2750 SOL	JTH WADSW	ORTH BLVI	D., #C-200,	DENVER, C		
Line	CONTRACT	•						PROPOSED TOTA	L CONTRACT PRICE		
Unit Duartic No. Unit Duartic No. Unit Total Manriours Average No. Co.	PURCHASE	REQUEST NUMBER			PROJECT NUM	BER		WORK LOCATION WHITE SAP	NDS MISSILE	BANGE, NE	W MEXICO
INSTALL ENERGY EFFICIENT			:		MATERIA	LCOST		LABOR COSTS			
INSTALL ENERGY EFFCIENT Measure	Line	Item	Cait	Quantity			Manhours	Average		Other Direct	Line
INSTALL BERGOV EFFICIENT INSTALL BERGOV EFFICIENT LAMPS EA 520 2.19 1138.8 0.09 27.60 1562.98 ENERGY EFFICIENT LAMPS EA 280 14.06 3665.60 0.85 27.60 6106.78 ENERGY EFFICIENT BALLASTS EA 280 14.06 3665.60 0.85 27.60 6106.78 INSTALL DRY-BULB ECONOMIZERS ON AHUS EA 3 255.00 705.00 10.00 35.81 1074.30 INSTALL DRY-BULB ECONOMIZERS ON AHUS EA 3 255.00 705.00 10.00 35.81 1074.30 INSTALL DRY-BULB ECONOMIZERS ON AHUS EA 3 255.00 705.00 10.00 35.81 1074.30 INSTALL DRY-BULB ECONOMIZERS ON AHUS EA 3 255.00 705.00 10.00 35.81 1074.30 INSTALL DRY-BULB ECONOMIZERS ON AHUS EA 2 2 256.00 452.00 10.00 35.81 1074.30 INSTALL DRY-BULB ECONOMIZERS ON AHUS EA 2 2 2 2 2 2 2 2 2	o N	3	Measure (2)	<u>(S</u>	£ 5	Total (5)	Mandays (6)	Rate	Total (8)	Costs (9)	Total (10)
A FT. ENERGY EFFICIENT LAMPS	-	INSTALL ENERGY EFFICIENT LAMPS AND BALLASTS									
ENERGY EFFICIENT BALLASTS		4 FT. ENERGY EFFICIENT LAMPS	Ð	520	2.19	1138.8	0.09	27.60	1262.98		\$2,401.78
2 INSTALL DRY-BULB ECONOMIZERS ON AHUS EA 9 147.50 1327.50 0.67 35.81 MIXED, RETURN, & OUTSIDE AIR SENSORS EA 9 147.50 1327.50 0.67 35.81 1 RECEIVER CONTROLLER W/ FIELD TEST EA 4 217.00 868.00 6.00 27.63 1 PNEUMATIC ACCUATORS (AHUS 2 & 3) EA 2 226.00 452.00 1.00 27.63 OUTSIDE AIR LOUVER SF 15 32.88 493.20 0.29 27.63 PNEUMATIC TUBING LF 120 0.70 84.00 0.09 27.63 A REPLACE MOTORS & ACTUATORS (AHU-1) EA 2 75.00 150.00 4.00 35.81 3 CHILLED WATER RESET ON WITH HI EFF MOTORS EA 3 776.00 12.00 27.60 4 REPLACE MOTORS WITH HI EFF MOTORS EA 3 345.00 1035.00 Includes material & labor 5 RESHEAVE FANS EA 3 345.00 1035.00 Includes mat		ENERGY EFFICIENT BALLASTS	EA	260	14.06	3655.60	0.85	27.60	6106.78		\$9,762.38
MIXED, RETURIN, & OUTSIDE AIR SENSORS		INSTALL DRY-BULB ECONOMIZERS ON AHUS									
HECEIVER CONTROLLER W/ FIELD TEST		MIXED, RETURN, & OUTSIDE AIR SENSORS	ā	6	147.50	1327.50	0.67	35.81	214.97		\$1,542.47
LOW-LEAKAGE DAMPERS (AHUs 2 & 3) EA 4 217.00 868.00 6.00 27.63 PNEUMATIC ACCUATORS (AHUs 2 & 3) EA 2 226.00 452.00 1.00 27.63 OUTSIDE AIR LOUVER SF 15 32.88 493.20 0.29 27.63 PNEUMATIC TUBING LF 120 0.70 84.00 0.09 27.63 REFURBISH DAMPERS & ACTUATORS (AHU-1) EA 2 75.00 150.00 4.00 35.81 CHILLED WATER RESET ON WTR-CLD CHILLER EA 2 25.00 650.00 12.00 27.60 REPLACE MOTORS WITH HI EFF MOTORS EA 3 716.00 2148.00 7.24 27.60 RESHEAVE FANS EA 3 345.00 1035.00 Includes material & labor		RECEIVER CONTROLLER W/ FIELD TEST	EA	ဗ	235.00	705.00	10.00	35.81	1074.30		\$1,779.30
PNEUMATIC ACCUATORS (AHUS 2 & 3) EA 2 226.00 452.00 1.00 27.63 OUTSIDE AIR LOUVER SF 15 32.88 493.20 0.29 27.63 PNEUMATIC TUBING LF 120 0.70 84.00 0.09 27.63 REFURBISH DAMPERS & ACTUATORS (AHU-1) EA 2 75.00 150.00 4.00 35.81 CHILLED WATER RESET ON WITH LIEFF MOTORS EA 2 325.00 650.00 12.00 27.60 REPLACE MOTORS WITH HI EFF MOTORS EA 3 345.00 1035.00 Includes material & labor TOTAL THIS SHEET EA 3 345.00 1035.00 Includes material & labor		LOW-LEAKAGE DAMPERS (AHUS 2 & 3)	E	4	217.00	868.00	6.00	27.63	663.12		\$1,531.12
OUTSIDE AIR LOUVER SF 15 32.88 493.20 0.29 27.63 PNEUMATIC TUBING LF 120 0.70 84.00 0.09 27.63 REFURBISH DAMPERS & ACTUATORS (AHU-1) EA 2 75.00 150.00 4.00 35.81 CHILLED WATER RESET ON WTR-CLD CHILLER EA 2 325.00 650.00 12.00 27.60 REPLACE MOTORS WITH HI EFF MOTORS EA 3 716.00 2148.00 7.24 27.60 RESHEAVE FANS EA 3 345.00 1035.00 Includes material & labor		PNEUMATIC ACCUATORS (AHUS 2 & 3)	ā	2	226.00	452.00	1.00	27.63	55.26		\$507.26
PNEUMATIC TUBING LF 120 0.70 84.00 0.09 27.63 REFURBISH DAMPERS & ACTUATORS (AHU-1) EA 2 75.00 150.00 4.00 35.81 CHILLED WATER RESET ON WTR-CLD CHILLER EA 2 325.00 650.00 12.00 27.60 REPLACE MOTORS WITH HI EFF MOTORS EA 3 716.00 2148.00 7.24 27.60 RESHEAVE FANS EA 3 345.00 1035.00 Includes material & labor		OUTSIDE AIR LOUVER	Ϋ́	15	32.88	493.20	0.29	27.63	118.53		\$611.73
REFURBISH DAMPERS & ACTUATORS (AHU-1) EA 2 75.00 150.00 4.00 35.81 CHILLED WATER RESET ON WTR-CLD CHILLER EA 2 325.00 650.00 12.00 27.60 REPLACE MOTORS WITH HI EFF MOTORS EA 3 716.00 2148.00 7.24 27.60 RESHEAVE FANS EA 3 345.00 1035.00 Includes material & labor		PNEUMATIC TUBING	Ħ	120	0.70	84.00	0.00	27.63	301.72		\$385.72
CHILLED WATER RESET ON WTR-CLD CHILLER EA 2 325.00 650.00 12.00 27.60 REPLACE MOTORS WITH HI EFF MOTORS EA 3 716.00 2148.00 7.24 27.60 RESHEAVE FANS EA 3 345.00 1035.00 Includes material & labor		REFURBISH DAMPERS & ACTUATORS (AHU-1)	ā	2	75.00	150.00	4.00	35.81	286.48		\$436.48
REPLACE MOTORS WITH HI EFF MOTORS EA 3 716.00 2148.00 7.24 27.60 RESHEAVE FANS EA 3 345.00 1035.00 Includes material & labor TOTAL THIS SHEET Includes material & labor A.5.00 1035.00 Includes material & labor	က	CHILLED WATER RESET ON WTR-CLD CHILLER	EA	2	325.00	650.00	12.00	27.60	662.40	•	\$1,312.40
RESHEAVE FANS EA 3 345.00 1035.00 TOTAL THIS SHEET	4	REPLACE MOTORS WITH HI EFF MOTORS	EA	3	716.00	2148.00	7.24	27.60	599.47		\$2,747.47
TOTAL THIS SHEET	2	RESHEAVE FANS	EA	3	345.00	1035.00	Includes mate	erial & labor			\$1,035.00
		TOTAL THIS SHEET									\$24,053.10

JOB

CALCULATED BY: DATE: CHECKED BY: DATE

LIGHTING

ENERGY SAVINGS CALCUI ATIONS

							בובוום סעוותם סעיים	5	3		ביוס				
	_		û	EXISTING				E	PROPOSED			DEMAND ENERGY	ENERGY	ANNOAL	CONSTRUCTION
HBS/	K.	BLDG. # HRS/YR # FIXTURES TYPE FIXTURE	TYPE	FIXTURE	TOTAL	KWH/YR	TOTAL KWHIYR # FIXTURES TYPE FIXTURE TOTAL KWHIYR REDUCTION SAVINGS	TYPE	FIXTURE	TOTAL	KWH/YR	REDUCTION	SAVINGS	W	COST
				(KW)	(KW)				(KW)	(KW)		(KW	(KWH)	(KWH) COST SAVINGS	ESTIMATE
N	2210	185	교	0.096		39249.6	185	4	0.071	13.135	29028.3	4.625	10221.3	\$1,308.14	
N,	210	4	ď	0.056	0.224	495.0	4	교	0.047	0.188	415.5	0.038	79.6	\$10.18	
						39744.6					29443.83	4.661	10300.8	\$1,318.32	\$11,023.00
	2210	192	7	960.0	18.432	40734.7	192	교	0.071	0.071 13.632	30126.7	4.800	10608.0	\$1,357.64	
••	2210	8	7	0.181	6.154	13600.3	34	귙	0.140	4.760	10519.8	1.394	3080.7	\$394.28	
						54335.1					40646.32	6.194	13688.7	\$1,751.92	\$15,194.83
	1		-	1											

KEY:

FL = FLUORESCENT IN = INCANDESCENT MV = MERCURY VAPOR MH = METAL HALIDE

D19-6

ESOS STUDY AT WSMR - BUILDING 23640
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
BLDG AUDIT PER SOW: ALT 1-BSLN, ALT2-ECO

Weather File Code: ELPASO.W Location:

Location:

 Latitude:
 31.0 (deg)

 Longitude:
 106.0 (deg)

 Time Zone:
 6

 Elevation:
 3,918 (ft)

 Barometric Pressure:
 25.8 (in. Hg)

Summer Clearness Number: 1.00
Winter Clearness Number: 1.00
Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 22: 3:19 3/ 2/92

Dataset Name: 23640B1 .TM

System 1 Peak SZ - SINGLE ZONE

*****	*****	******	COOLING COIL	. PEAK ****	*****	*****	****	**** CLG	SPACE	PEAK ****	***** HE	ATING CO	IL PEAK	*****
Peaked a	t Time ==	:>	Mo/Hr:	7/16			*	Ма	/Hr:	7/16 *	į.	Mo/Hr	: 13/ 1	
Outside	Air ==>	O.A	DB/WB/HR:	97/ 64/ 49.	0		*	O	ADB:	97	•	OADB	: 24	
		Space	Ret. Air	Ret. Air	Ne	t Percn	t *	s	pace	Percnt *	Space P	eak Co	il Peak	Percnt
	s	ens.+Lat.	Sensible	Latent	Tota	l Of To	t *		ible	Of Tot *	•		ot Sens	Of Tot
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh) (%	*		tuh)	(%) *		:uh)	(Btuh)	(%)
Skylit	e Solr	0	C	}		0.0	0 *		0	0.00		0	0	0.00
Skylit	e Cond	0	C)		0.0	0 *		0	0.00 *	•	0	0	0.00
Roof C	ond	154,401	C	1	154,40	1 39.7	9 *	155	, 165	46.20 *	-76,	385	-76,385	56.43
Glass	Solar	0	C)	1	0.0	0 *		0	0.00 *	,	0	0	0.00
Glass	Cond	0	0	1	(0.0	0 *		0	0.00 +	•	0	0	0.00
Wall C	ond	42,904	0	1	42,90	4 11.0	6 *	42	, 265	12.58 *	-57,	499	-57,499	42.48
Partit	ion	0			1	0.0	0 *		0	0.00 *	,	0	0	0.00
Expose	d Floor	0			1	0.0	0 *		0	0.00 *	-7,	337	-7,337	5.42
Infilt	ration	27,923			27,92	3 7.1	9 *	22	,257	6.63 *	-19,	982	-19,982	14.76
Sub To	tal==>	225,228	0)	225,22	8 58.0	4 *	219	,687	65.41 *	•		161,203	119.09
Internal	Loads						*			4			•	
Lights		42,159	0	•	42,15	9 10.8	6 *	42	, 159	12.55 *		0	0	0.00
People		6,300			6,30	0 1.6	2 *	3	,450	1.03 *		0	0	0.00
Misc		88,118	0	0	88,11	8 22.7	1 *	70	,118	20.88 *		0	0	0.00
Sub To	tal==>	136,577	0	0	136,57	7 35.1	9 *	115	,727	34.46 *		0	0	0.00
Ceiling	Load	0	0	1	(0.0	0 *		0	0.00 *		0	0	0.00
Outside .		0	0	0	(0.0	0 *		0	0.00 *		0	0	0.00
Sup. Fan					25,84	2 6.6	6 *			0.00 *			25,842	- 11
Ret. Fan			0			0.0	0 *			0.00 *			0	Ü. oo
Duct Hea			0		(0 *			0.00 *			0	0.00
OV/UNDR	•	440	_		441		1 *		440	0.13 *		0	0	0.00
Exhaust			0	_		0.0				0.00 *			0	0.00
Terminal	sypass		0	0	(0.0	0 *			0.00 *			0	0.00
Grand To	tal==>	362,245	. 0	0	388,08	7 100.0	0 *	335	,855	100.00 *	-161,	203 -	135,361	100.00
					F1 F47 T411						·		•	
	Total	Capacity		LING COIL S Coil Airfl		ing DB/W		Lea	vina Di	B/WB/HR	Gross To	7014	NS Glass (s:	f) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)		eg F Gr			-	Grains	Floor	6,677		, (,,,
Main Clg	32.3	388.1	361.6	15,800	_		40.0	48.1	42.2		Part	800		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0		ExFlr	222		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	6,677		0 0
Totals	32.3	388.1									Wall	3,650		0 0
	HEATIN	G COIL SEL	ECTION	•	A1	IRFLOWS	(cfm)		1	ENGINEERING	CHECKS	TEMF	ERATURES	(F)
	Capacit	y Coil A	irfl Ent	Lvg	Type	Cooling	9	Heating	Cl	3 % CA	0.0	Туре		Htg
	(Mbh)	(cf	m) Deg F	Deg F	Vent	(0	0		g Cfm/Sqft	2.37	SADB	49.8	-
Main Htg	-0.	0 15,	800 76.9	76.9	Infil	919	9	474	Cl	Cfm/Ton	488.55	Plenum		
Aux Htg	0.0	0	0.0	0.0	Supply	15,80	0	15,800	CL	g Sqft/Ton	206.46	Return	72.0	
Preheat	-0.0	•	800 68.0	48.1	Mincfm	(0	0	Cle	Btuh/Sqft	58.12	Ret/OA	72.0	
Reheat	0.0		0.0	0.0	Return	15,80	0	15,800	No.	. People	15	Runarr	nd 72.0	68.0
Humidif	-0.1		474 4.7		Exhaust	. (0	0	Hts	3 % OA	0.0	Fn Mtr	TD 0.4	0.0
Opt Vent	0.0	כ	0.0	0.0	Rm Exh		0	0	u+,	Cfm/SqFt	2.37	Fn Blo	ITD 0.3	0.0
Total	-0.6	_			Auxil			U	400	a crimadir	2.31	rii bit	110 0.3	

By: Trane Customer Direct Service Network

System	2	Block	RAD -	RADIATIO	N							
******	*****	****** CO	OLING COIL F	PEAK *****	*****	*****	***** CLG S	SPACE PEAK ****	***** HEATIN	G COIL PEAK	****	****
Peaked at	t Time ==>	•		0		•	Mo/I	ir: 0/0 *		4o/Hr: 13/ 1	J	
Outside A	\ir ==>	CAD	B/WB/HR: (0, 0/ 0.0	l	•	CAL	B: 0 *		OADB: 24		
		_							Anna Barb	outt out		
		Space		Ret. Air		Percnt '	Spi		•			ercnt
		ens.+Lat.	Sensible	Latent	Total	Of Tot			Space Sens	Tot Sens		f Tot
Envelope		(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	,,,,,		(0:4.,	(Btuh)		(%)
Skylite		0	0		0	0.00		0 0.00 *	•	(0.00
Skylite		0	. 0		0	0.00		0 0.00 *	_			0.00
Roof Co		0	0		0	0.00 1		0 0.00 *	-72,072	-	י ס	46.12
Glass S		0	0		0				_		0	0.00
Glass (0	0		0			0 0.00 *	-			36.80
Wall Co		0	0		0			0 0.00 *	2.,			
Partit		0			0	••••		0 0.00			0	0.00
	d Floor	0			0			0 0.00 *	-			4.70
Infilt		0	•		0			0 0.00 *				12.39
Sub To		0	0		0	0.00	- *	0 0.00 *	-156,261	-156,26		00.00
Internal		0	0		0	0.00		0 0.00	. 0	:	0	0.00
Lights People		0	J		0		*	0 0.00	_		0	0.00
Misc		0	0	0	0		*	0 0.00	• 0		0	0.00
Sub To	tal==>	0	0	0	0		*	0 0.00	• 0		0	0.00
Ceiling i		0	0	•	0			0 0.00			0	0.00
Outside .		0	0	. 0	0			0 0.00			0	0.00
Sup. Fan		·	•	•	0		*	0.00	,		0	0.00
Ret. Fan			0		0		* -	0.00	•		0	0.00
Duct Hea			0		0		*	0.00	•		0	0.00
OV/UNDR		0	_		0		*	0 0.00	• 0	J	0	0.00
Exhaust	-		0	0	0		*	0.00	•		0	0.00
Terminal			0	0	0	0.00	*	0.00	•		0	0.00
	•						*	•	•			
Grand To	tal==>	0	0	0	O	0.00	*	0 0.00	-156,261	-156,26	1 1	00.00
		*****	cool	ING COIL S	ELECTION					AREAS		
	Total	Capacity	Sens Cap.	Coil Airfl	Enteri	ng DB/WB/H	R Leav	ring DB/WB/HR	Gross Total	Glass	(sf)	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	g F Grain	s Deg F	Deg F Grains	Floor 6	300		
Main Clg	0.0	0.0	0.0	0	0.0	0.0 0.		0.0 0.0	Part	0		
Aux Clg	0.0	0.0	0.0	0		0.0 0.		0.0 0.0	Exflr	222		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0 0.	0.0	0.0 0.0		5,300	C	
Totals	0.0	0.0							Wall 3	3,650	C	0 0
	HEATIN		ECTION				m)	ENGINEERIN		TEMPERATU		(F)
	Capacit	•		Lvg	Туре	Cooling	Heating	Clg % OA	0.0		:lg	Htg
	(Mbh)			Deg F	Vent	0	0	Clg Cfm/Sqft			0.0	68.1
Main Htg	-178.		0 0.0	0.0	Infil	0	459	Clg Cfm/Ton	0.00		0.0	68.0
Aux Htg	0.		0 0.0	0.0	Supply	0	0	Clg Sqft/Ton		Return	0.0	68.0
Preheat	0.		0 0.0	0.0	Mincfm	0	0	Clg Btuh/Sqf		Ret/OA	0.0	68.0
Reheat	0.		0 0.0	0.0	Return	0	0	No. People	0	Runarnd	0.0	68.0
Humidif	0.		0 0.0	0.0	Exhaust	0	0	•	0.0	Fn MtrTD	0.0	0.0
Opt Vent	0.		0 0.0	0.0	Rm Exh	0	0	Htg Cfm/SqFt		Fn BldTD	0.0	0.0
Total	-178.	.2			Auxil	0	0	Htg Btuh/SqF	t -28.29	Fn Frict	0.0	0.0

V 600 PAGE

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 23640

----- BUILDING U-VALUES-----

					Roo	m U-Val	ues			•••••	Room	Room
					(Btu	/hr/sqf	t/F)				Mass	Capac.
Room				Summr	Wintr		Summer	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	ROOM 1	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	68.9	14.43
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	68.9	14.43
2	RM 2 - INTERIOR	0.388	0.000	0.000	0.000	0.260	0.000	0.000	0.000	0.000	47.1	10.07
Zone	2 Total/Ave.	0.388	0.000	0.000	0.000	0.260	0.000	0.000	0.000	0.000	47.1	10.07
3	ROOM 3	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	32.2	7.10
Zone	3 Total/Ave.	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	32.2	7.10
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	44.6	9.57
1	ROOM 1	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	68.9	14.43
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	68.9	14.43
3	ROOM 3	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	32.2	7.10
Zone	3 Total/Ave.	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	32.2	7.10
System	2 Total/Ave.	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	44.4	9.55
Buildin	g	0.388	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	44.5	9.56

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 23640

Room			er of icate	Floor Area/Dupl Room	Total Floor Area	Partition Area	Exposed Floor Area	Skylight Area	Skl /Rf	Net Roof Area	Window Area	Win /Wl	Net Wall Area
Number	Description	Flr	Rm	(sqft)	(sqft)	(sqft)	(sqft)	(sqft)	(%)	(sqft)	(sqft)	(%)	(sqft)
1	ROOM 1	1	1	2,100	2,100	0	154	0	0	2,100	0	0	2,460
Zone	1 Total/Ave.				2,100	0	154	0	0	2,100	0	0	2,460
2	RM 2 - INTERIOR	1	1	377	377	800	0	0	0	377	0	0	0
Zone	2 Total/Ave.				377	800	0	0	0	377	0	0	0
3	ROOM 3	1	1	4,200	4,200	0	68	0	0	4,200	0	0	1,190
Zone	3 Total/Ave.				4,200	0	68	0	0	4,200	0	0	1,190
System	1 Total/Ave.				6,677	800	222	0	0	6,677	0	0	3,650
1	ROOM 1	1	1	2,100	2,100	0	154	0	0	2,100	0	0	2,460
Zone	1 Total/Ave.				2,100	0	154	0	0	2,100	0	0	2,460
3	ROOM 3	1	1	4,200	4,200	0	68	0	0	4,200	0	0	1,190
Zone	3 Total/Ave.				4,200	0	68	0	0	4,200	0	0	1,190
System	2 Total/Ave.				6,300	0	222	0	0	6,300	0	0	3,650
Buildin	g				12,977	800	445	0	0	12,977	0	0	7,300

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1

ystem To	tals	X	_						2	Atou-	m.		
ercent	cool	ing Loa	d	Heati	ng Load		Cooling	Airflow			Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours		Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)			(Cfm)	(%)	
	1		/)			
0 - 5	1.6	0	0	-8,912	0	0	790.0	0	0	0	0.0	0	(
5 - 10	3.2	0	0	-17,824	0	0	1,580.0	0	0	0	0.0	0	
0 - 15	4.9	0	0	-26,736	0	0	2,370.0	0	0	٥	0.0	0	
5_ 20	6.5	29	2,570	-35,648	0	0	3,160.0	0	0	16705	0.0	0	
0 - 25	8.1	9	772	-44,561	0	0	3,950.0	0	0	6253	0.0	0	
5 - 30	9.7	10	876	-53,473	0	0	4,740.0	0	0	8497	0.0	0	
0 - 35	11.3	8	700	-62,385	0	0	5,530.0	0	0	7960	0.0	0	
5 - 40	12.9	9	816	-71,297	0	0	6,320.0	0	0	10526	0.0	0	
0 - 45	14.6	8	702	-80,209	0	0	7,110.0	0	0	10249	0.0	0	
5 - 50	16.2	5	455	-89,121	0	0	7,900.0	0	0	7371	0.0	0	
0 - 55	17.8	5	425	-98,033	0	0	8,690.0	0	0	7565	0.0	0	
5 - 60	19.4	5	395	-106,945	0	0	9,480.0	0	0	7663	0.0	0	
0 - 65	21.0	3	245	-115,857	0	0	10,270.0	0	0	5145	0.0	0	
5 - 70	22.6	3	261	-124,769	0	0	11,060.0	0	0	5899	0.0	0	
0 - 75	24.3	3	232	-133,682	0	0	11,850.0	0	. 0	5638	0.0	0	
5 - 80	25.9	2	140	-142,594	0	0	12,640.0	0	0	3626	0.0	0	
0 - 85	27.5	1	108	-151,506	0	0	13,430.0	0	0	2470	0.0	0	
5 - 90	29.1	1	63	-160,418	0	0	14,220.0	0	0	18 33	0.0	0	
0 - 95	30.7	0	0	-169,330	0	0	15,010.0	0	0		0.0	0	
5 - 100	32.3	0	0	-178,242	0	0	15,800.0	100	8,760		0.0	0	
ours Off	0.0	0	0	0	0	8,760	0.0	0	0		0.0	0	8,76

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------ MONTHLY ENERGY CONSUMPTION ------

	ELEC	DEMAND	GAS		GAS DMND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(kWh)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)
Jan	55,976	107	1,318	28	2
Feb	50,346	107	982	24	1
March	55,358	110	250	23	0
Aprîl	54,671	113	0	27	0
May	59,801	116	0	39	0
June	60,645	118	0	46	0
July	63,781	120	0	53	0
Aug	63,876	119	0	51	0
Sept	58,739	115	0	39	0
Oct	56,848	111	4	26	0
Nov	53,568	107	484	24	1
Dec	55,643	107	1,060	27	1
Total	689,253	120	4,098	407	2

Building Energy Consumption = Source Energy Consumption = 413,692 (Btu/Sq Ft/Year) 415,590 (Btu/Sq Ft/Year) Floor Area =

6,677 (Sq Ft)

E Monthly KW= 1,350

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

•••••		PEAK	C H E C K S U M S
Utility	ELECTRIC DEMAND		

Peak Value 120.0 (kW) Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

Eap.			Utility	Percnt
Ref.	Equipment	•	Demand	Of Tot
Num.	Code Name	Equipment Description	(kW)	(%)
Cooling	Equipment			
1	EQ1070L	WTR-CLD RECIP >30 TONS	41.9	34.92
Sub Tota	al		41.9	34.92
Sub Tota	al		0.0	0.00
Air Mov	ing Equipment	•		
1		SUMMATION OF FAN ELECTRICAL DEMAND	29.8	24.86
Sub Tot	al		29.8	24.86
Sub Tot	al		0.0	0.00
Miscell	aneous			
Lights			24.0	20.00
	Utilities		0.0	0.00
Misc E	quipment		24.3	20.21
Sub Tot			48.3	40.22
Grand 1	Total		120.0	100.00

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TRACE 600
           ANALYSIS
by
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ESOS STUDY AT WSMR - BUILDING 23640 WHITE SANDS MISSILE RANGE NM US ARMY EMC ENGINEERS, INC.

Time/Date Program was Run:

Dataset Name:

BLDG AUDIT PER SOW: ALT 1-BSLN, ALT2-ECO

(MUDIFIED CONFIGURATION)

Weather File Code: ELPASO.W Location: Latitude: 31.0 (deg) Longitude: 106.0 (deg) Time Zone: 6 Elevation: 3,918 (ft) 25.8 (in. Hg) Barometric Pressure: Summer Clearness Number: 1.00 Winter Clearness Number: 1.00 Summer Design Dry Bulb: 98 (F) Summer Design Wet Bulb: 64 (F) Winter Design Dry Bulb: 24 (F) Summer Ground Relectance: 0.20 Winter Ground Relectance: 0.20 0.0653 (Lbm/cuft) Air Density: Air Specific Heat: 0.2444 (Btu/lbm/F) Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F) Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft) Enthalpy Factor: 3.9171 (Lb-min./hr/cuft) Design Simulation Period: January To December System Simulation Period: January To December Cooling Load Methodology: TETD/Time Averaging

13:39:49

23640 .TM

3/ 8/92

D19-15

V 600 PAGE

System SZ Peak - SINGLE ZONE

eaked at Time	/	Mo/Hr:	// 10			*	Mo/Hr:	1/10	•	Mo/Hr:	13/ 1		
outside Air ==>	OA	DB/WB/HR:	97/ 64/ 49.	0		*	OADB:	.97	•	OADB:	24		
	£naaa	Dat din	D.A. 15-			*	_						
	Space Sens.+Lat.	Sensible	Ret. Air		Percnt		Space				Peak	Per	
invelope Loads	(Btuh)			Total			Sensible		•		Sens	Of	
Skylite Solr	(81011)	(Btuh)		(Btuh)	• • • • • • • • • • • • • • • • • • • •		(Btuh)			-	Btuh)		()
Skylite Cond	_	0		(0			0	0		0.0
Roof Cond	140 124	0		4/0.40			0			0			0.0
	149,124	0		149,124			149,957		•		6,385		7.6
Glass Solar	0	0		(0			0	0	0	0.0
Glass Cond	0	0					0			0	0	Q	0.6
Wall Cond	38,984	0		38,984			38,345		•	99 -57	7,499	35	5.8
Partition	0			(0	0.00	•	0	0	0	0.0
Exposed Floor	0			(0.00	*	0	0.00	-7,3	37 - 7	7,337	4	4.!
Infiltration	10,713			10,713	3.04	*	10,127	3.37	-19,9	82 -19	9,982	12	2.4
Sub Total==>	198,821	0		198,821	56.42	*	198,429	65.99	-161,2	03 -16	1,203	100	١.:
nternal Loads						*		1	•				
Lights	26,252	0		26,252	7.45	*	26,252	8.73	•	0	0	e	٥.,
People	6,300			6,300	1.79	*	3,450	1.15	,	0	0	0	٥.
Misc	90,040	0	0	90,040	25.55	*	72,040	23.96	•	0	0		0.1
Sub Total==>	122,592	0	0	122,592	34.79	*	101,742	33.84	•	0	0		0.
eiling Load	0	0		(0.00	*	0	0.00	•	0	0		0.
utside Air	. 0	0	. 0	10,364	2.94	*	0	0.00	,	0 -19	9,211	11	
⊔p. Fan Heat				20,134	5.71	*		0.00 *			0,134	-17	4
et. Fan Heat		0			0.00	*		0.00			0		
uct Heat Pkup		0		C	0.00	*		0.00			Õ		٥.
//UNDR Sizing	512			512			512			0	o o),
xhaust Heat		0	0	C		*		0.00		•	0).(
erminal Bypass		0	0	C		*		0.00			0).(
rand Total==>	321,925	0	0	352,423	100.00	*	300,683	100.00 *	-161,20	03 -160	0,280	100)_(
	************	cooi	LING COIL SE	LECTION						AREAS-			
Total	Capacity	Sens Cap.	Coil Airfl	Enteri	ng DB/WB/	'HR	Leaving	DB/WB/HR	Gross Tota	al Gla	ass (sf	f) (×
(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	g F Grai	ns De	g F Deg	F Grains	Floor	6,677			
n Clg 29.4	352.4	330.4	12,870	75.8 5	6.1 46	5.9 4	9.0 44	.6 43.8	Part	800			
Clg 0.0	0.0	0.0	0	0.0	0.0	.0	0.0 0	.0 0.0	ExFlr	222			
Vent 0.0	0.0	0.0	0	0.0	0.0	.0	0.0 0	.0 0.0	Roof	6,677		0	
als 29.4	352.4								Wall	3,650		0	
HEAT I				AI	RFLOWS (c	:fm)		·-ENGINEERING	CHECKS	TEMPER	ATURES	(F)	, –
Capaci	-	irfl Ent	Lvg	Type	Cooling	Heat	ing (lg % OA	3.5	Type	Clg	H	lt
(Mbh) (cfn	n) Deg F	Deg F	Vent	456		456	clg Cfm/Sqft	1.93	SADB	50.6		31
n Htg -160	•	370 66.4	79.4	Infil	474			ig Cfm/Ton	438.22	Plenum	75.0		
: Htg 0	.0	0.0	0.0	Supply	12,870	12	,870	lg Sqft/Ton	227.35	Return	75.0		
heat -0	.0 12,8	370 66.4	49.0	Mincfm	0			ig Btuh/Sqft		Ret/OA	75.8		
eat 0	.0	0.0	0.0	Return	12,870	12		io. People	15	Runarnd	75.0		
idif -11	.6 9	30 4.7	25.3	Exhaust	456	· - ·		itg % OA	3.5	Fn MtrTD			0
Vent 0	.0	0.0	0.0	Rm Exh	0			itg Cfm/SqFt	1.93	Fn BldTD			0
al -171					-			~ - · · · · · · · · · · · ·		3.4.0	٠.,		•

Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

BUILDING U-VALUES - ALTERNATIVE 2 ECO - BUILDING 23640

------ BUILDING U-VALUES-----

					Roo	m U-Val	ues				Room	Room
					(Btu	/hr/sqf	t/F)				Mass	Capac.
Room				Summr	Wintr		Summer	Wintr			(lb/	(Btu/
Number	Description	Part.	Exflr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	ROOM 1	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	68.9	14.43
Zone	1 Total/Ave.	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	68.9	14.43
2	RM 2 - INTERIOR	0.388	0.000	0.000	0.000	0.260	0.000	0.000	0.000	0.000	47.1	10.07
Zone	2 Total/Ave.	0.388	0.000	0.000	0.000	0.260	0.000	0.000	0.000	0.000	47.1	10.07
3	ROOM 3	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	32.2	7.10
Zone	3 Total/Ave.	0.000	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	32.2	7.10
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	44.6	9.57
Buildin	g	0.388	0.750	0.000	0.000	0.260	0.000	0.000	0.358	0.000	44.6	9.57

BUILDING AREAS - ALTERNATIVE 2 ECO - BUILDING 23640

BUILDING AREAS

Room Number	Descr	iption	Number Dupli	-	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	ROOM	1	1	1	2,100	2,100	0	154	0	0	2,100	0	0	2,460
Zone	1	Total/Ave.				2,100	0	154	0	0	2,100	0	0	2,460
2	RM 2	- INTERIOR	1	1	377	377	800	0	0	0	377	0	0	0
Zone	2	Total/Ave.				377	800	0	0	0	377	0	0	0
3	ROOM	3	1	1	4,200	4,200	0	68	0	0	4,200	0	0	1,190
Zone	3	Total/Ave.				4,200	0	68	0	0	4,200	0	0	1,190
System	1	Total/Ave.				6,677	800	222	0	0	6,677	·O	0	3,650
Buildin	ng					6,677	800	222	0	0	6,677	0	0	3,650

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2

System Totals

Percent	Cool	ing Loa	d	Weatin	g Load		Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	1.5	19	1,271	-8,592	63	5,500	643.5	0	0	0.0	O	0
5 - 10	2.9	11	762		12			0	0		_	
				-17,184		1,030	1,287.0		-	0.0	0	0
	4.4	3	214	-25,776	5	444	1,930.5	0	0	0.0	0	0
15 - 20	5.9	9	588	-34,369	3	259	2,574.0	0	0	0.0	0	0
20 - 25	7.3	9	573	-42,961	2	172	3,217.5	0	0	0.0	0	0
25 - 30	8.8	7	455	-51,553	1	124	3,861.0	0	0	0.0	0	0
30 - 35	10.3	5	342	-60,145	2	139	4,504.5	0	0	0.0	0	0
35 - 40	11.7	4	281	-68,737	1	68	5,148.0	0	0	0.0	0	0
40 - 45	13.2	5	329	-77,329	2	184	5,791.5	0	0	0.0	0	0
45 - 50	14.7	3	232	-85,921	2	157	6,435.0	0	0	0.0	0	0
50 - 55	16.2	4	262	-94,514	2	146	7,078.5	0	0	0.0	0	0
55 - 60	17.6	3	197	-103,106	3	232	7,722.0	0	0	0.0	0	0
60 - 65	19.1	4	261	-111,698	1	90	8,365.5	0	0	0.0	0	0
65 - 70	20.6	4	268	-120,290	1	96	9,009.0	0	0	0.0	0	0
70 - 75	22.0	3	208	-128,882	1	119	9,652.5	0	0	0.0	0	0
75 - 80	23.5	3	190	-137,474	0	0	10,296.0	0	0	0.0	0	0
80 - 85	25.0	1	90	-146,066	0	0	10,939.5	0	0	0.0	0	0
85 - 90	26.4	2	106	-154,659	0	0	11,583.0	0	0	0.0	0	0
90 - 95	27.9	0	20	-163,251	0	0	12,226.5	0	0	0.0	0	0
95 - 100	29.4	0	0	-171,843	0	0	12,870.0	100	8,760	0.0	0	0
Hours Off	0.0	0	2,111	0	0	0	0.0	0	0	0.0	0	8,760

TOT . TOW . HES = 61,121

(8760 -2111)

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

------ MONTHLY ENERGY CONSUMPTION -----

	ELEC	DEMAND	GAS		GAS DMND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(kWh)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)
Jan	26,618	71	654	0	2
Feb	24,446	71	483	1	2
March	30,958	71	123	5	1
April	35,447	75	47	15	0
May	42,288	78	54	31	0
June	43,954	80	59	41	0
July	46,880	82	36	48	0
Aug	46,573	81	32	45	0
Sept	42,309	77	15	33	0
0ct	36,656	73	12	14	0
Nov	29,591	71	204	4	1
Dec	26,967	71	490	1	1
Total	432,687	82	2,208	239	2

Building Energy Consumption =
Source Energy Consumption =

254,245 (Btu/Sq Ft/Year) 255,268 (Btu/Sq Ft/Year)

Floor Area =

6,677 (Sq Ft)

1 Monthly KW = 901

UTILITY PEAK CHECKSUMS - ALTERNATIVE 2

U T I L I T Y	PEAK	C H E C K S U M S

Utility ELECTRIC DEMAND

Peak Value 81.8 (kW)
Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

_			Utility	Percent
Eqp.	F		Demand	
Ref.	Equipment	Equipment Description	(kW)	(%)
Num.	Code Name	Equipment bescription	(//4/	(~)
Cooling Ed	quipment			
1	EQ1070L	WTR-CLD RECIP >30 TONS	38.9	47.61
Sub Total			38.9	47.61
Reating E	quipment			
1	EQ2002	GAS FIRE TUBE STEAM	1.0	1.19
Sub Total			1.0	1.19
Air Movin	g Equipment			
1		SUMMATION OF FAN ELECTRICAL DEMAND	13.1	15.97
Sub Total			13.1	15.97
Sub Total			0.0	0.00
Miscellan	eous			
Lights			7.7	9.41
Base Uti	lities		0.0	0.00
Misc Equ	nipment		21.1	25.82
Sub Total			28.8	35.23
Grand Tot	al		81.8	100.00

ESOS STUDY AT WSMR - BUILDING 23642
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENGINEERS, INC.
BLDG AUDIT PER SOW: ALT 1-BSLN, ALT2-ECO

Weather File Code: ELPASO.W

Location:

 Latitude:
 31.0 (deg)

 Longitude:
 106.0 (deg)

 Time Zone:
 6

 Elevation:
 3,918 (ft)

Barometric Pressure: 25.8 (in. Hg)

Summer Clearness Number: 1.00
Winter Clearness Number: 1.00
Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December

Cooling Load Methodology: TETD/Time Averaging

Time/Date Program was Run: 20:19:15 3/ 3/92

Dataset Name: 23642A .TM

-,· ······· ---······

Total

-89.8

Peak SZ - SINGLE ZONE Peaked at Time ==> Mo/Hr: 7/16 Mo/Hr: 6/16 Mo/Hr: 13/ 1 OADB: 97 OADB: 24 Outside Air ==> OADB/WB/HR: 97/ 64/ 49.0 Ret. Air Ret. Air Net Percnt Space Percnt * Space Peak Coil Peak Space Percnt Total Of Tot Of Tot * Of Tot Sensible Space Sens Tot Sens Sens.+Lat. Sensible Latent (%) (Btuh) (Btuh) (%) (Btuh) (Btuh) (%) Envelope Loads (Btuh) (Btuh) (Btuh) 0.00 0.00 * Skylite Solr 0 0 0 0 n n 0.00 0.00 * 0 0 0.00 Skylite Cond 0 0 0 0.00 0 43,919 34.25 47.13 * -23,519 -23,519 26.20 43,919 44.277 Roof Cond n 0.00 * 0 Glass Solar 0 0 0 0.00 0 0 0.00 0.00 0.00 * 0 Glass Cond 0 0 0 0 0 0.00 10.30 * 9,987 7.79 -20,693 -20,693 23.05 9,987 n 9,672 Wall Cond 0 0 0.00 0 0.00 * 0 0 0.00 Partition Exposed Floor 0 0 0.00 0 0.00 * -3,334 -3,334 3.71 4.50 * Infiltration 4,177 3.26 4,224 -8,713 -8,713 9.71 4,177 61.92 * Sub Total ==> 58,082 0 58,082 45.29 58,173 -56,260 -56,260 62.67 Internal Loads 26,549 26,549 20.70 26,549 28.26 * 0 0.00 Lights 0 5.460 5,460 4.26 2,990 3.18 * 0 0 0.00 People 6,232 6,232 0 0.00 0 4.86 6,232 6.63 * 0 Misc 0 29.82 Sub Total ==> 38,241 0 38,241 35,771 38.08 * n 0 0.00 Ceiling Load 0 0 0.00 0 0.00 * O 0 0.00 Outside Air 0 21,198 16.53 0 0.00 -44,221 49.26 10,713 8.35 0.00 10,713 -11.93 Sup. Fan Heat 0.00 * 0.00 Ret. Fan Heat 0 0 0 0.00 0 0.00 0.00 * 0 0.00 Duct Heat Pkup OV/UNDR Sizing 0 O 0.00 O 0.00 n 0 0.00 0.00 0.00 O ٥ 0.00 Exhaust Heat O 0 O 0 0.00 0.00 0.00 Terminal Bypass n 128,234 100.00 * 93,944 Grand Total==> 96,323 100.00 -56,260 -89,768 ------AREAS-----Total Capacity Sens Cap. Coil Airfl Entering DB/WB/HR Leaving DB/WB/HR Gross Total Glass (sf) (%) Deg F Deg F Grains Deg F Deg F Grains 3,652 (Tons) (Mbh) (Mbh) (cfm) Floor Main Clg 10.7 128.2 126.1 10,043 77.2 57.2 49.4 64.1 52.3 48.9 Part 800 Aux Clg 0.0 0.0 0 0.0 0.0 0.0 0.0 ExFlr 97 0.0 0.0 0.0 Opt Vent 0.0 0.0 0.0 0 0.0 0.0 0.0 0.0 0.0 0.0 Roof 3,652 0 0 Totals 10.7 128.2 Wall 1,257 ------HEATING COIL SELECTION----------- AIRFLOWS (cfm)-------- ENGINEERING CHECKS----TEMPERATURES (F)---Capacity Coil Airfl Cooling Heating Clg % OA 10.0 Clg Lvg Type Type Htg (Mbh) (cfm) Deg F Deg F Vent 1,004 1,004 Clg Cfm/Sqft 2.75 SADB 65.2 75.9 Main Htg -89.8 10.043 65.4 74.7 198 198 Infil Clg Cfm/Ton 939.81 Plenum 75.0 70.0 0.0 341.75 Aux Htg 0 0.0 0.0 10,043 10,043 75.0 70.0 Supply Clg Sqft/Ton Return Preheat -25.0 10,043 65.4 68.0 Mincfm 0 0 Clg Btuh/Sqft 35.11 Ret/OA 77.2 65.4 0.0 0.0 0.0 10,043 10,043 Reheat 0 Return No. People 13 Runarnd 75.0 **Humidif** 0.0 0.0 0.0 1,004 1,004 Htg % OA 10.0 0 Exhaust Fn MtrTD 0.4 0.0 Opt Vent 0.0 0.0 0.0 0 0 2.75 0 Rm Exh Htg Cfm/SqFt Fn BldTD 0.3 0.0

0

0

Htg Btuh/SqFt

-24.58

Fn Frict

0.8

0.0

Auxil

System	2	Peak	SZ	-	SINGLE ZONE

Peaked a	t Time ==:	•	Mo/Hr:	7/16			-	mu	/Hr:	1711	-	Ma/Hr	: 13/ 1	
Outside .	Air ==>	OAL		97/ 64/ 49.	0		*		ADB:	•	*	-	: 24	
							*							
	÷	Space	Ret. Air	Ret. Air	Net	t Percnt	*	s	pace	Percnt	* Space F	eak Co	il Peak	Percn
	Se	ens.+Lat.	Sensible	Latent	Total	l Of Tot	*	Sens	ible	Of Tot	* Space S	Sens T	ot Sens	Of To
Envelope	Loads	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(B	tuh)	(%)	* (B1	tuh)	(Btuh)	(%
Skylit	e Solr	0	()	(0.00	*		0	0.00	*	0	0	0.0
Skylit	e Cond	0	()	(0.00	*		0	0.00	*	0	0	0.0
Roof C	ond	43,919	()	43,919	33.53	*	42	,027	40.03	* -23,	,519	-23,519	28.10
Glass		0	0)	(0.00	*	•	0	0.00	t .	0	0	0.0
Glass		0	C)	(0.00	*		0	0.00	è	0	0	0.0
Wall C	ond	11,201	C)	11,201	8.55	*	13	,406	12.77	* -20,	,693	-20,693	24.7
Partit	ion	0			(0.00	*		0	0.00	*	0	0	0.0
Expose	d Floor	0			(0.00	*		0	0.00	* -3,	,334	-3,334	3.98
Infilt	ration	3,684			3,684	2.81	*	3	,940	3.75	* -8,	,713	-8,713	10.4
Sub To	tal==>	58,804	C)	58,804	44.90	*	59	,373	56.55	• -56,	,260	-56,260	67.2
Internal	Loads						*			•			•	
Lights		36,396	C)	36,396	27.79	*	36	,396	34.67	•	0	0	0.00
People		5,460			5,460	4.17	*	2	,990	2.85	t	0	0	0.00
Misc		6,232	0	0	6,232	4.76	*	6	,232	5.94	k	0	0	0.00
Sub To	tal==>	48,088	0	0	48,088	36.72	*	45	,618	43.45	t .	0	0	0.00
Ceiling	Load	0	0	1	C	0.00	*		0	0.00	t .	0	0	0.00
Outside /	Air	0	0	0	15,309	11.69	*		0	0.00	t	0 -	-36,205	43.26
Sup. Fan	Heat				8,765	6.69	*			0.00	t		8,765	-10.47
Ret. Fan	Heat		0	•	0	0.00	*			0.00	r		0	0.00
Duct Hear	t Pkup		0	1	0	0.00	*			0.00	r		0	0.00
OV/UNDR :	Sizing	0			0	0.00	*		0	0.00	+	0	0	0.00
Exhaust I	Heat		0	0	0	0.00	*			0.00	+		0	0.00
Terminal	Bypass		0	0	0	0.00	*			0.00	•		0	0.00
							*			•	•			
Grand Tot	tal==>	106,892	0	0	130,966	100.00	*	104	,990	100.00	-56,	260 -	-83,700	100.00
			coo	LING COIL S	ELECTION							ARE/	\S	
	Total C	apacity	Sens Cap.	Coil Airfl	Enteri	ng DB/WB	/HR	Leav	ving [B/WB/HR	Gross To	tal (Glass (s	f) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	g F Gra	ins	Deg F	Deg f	Grains	Floor	3,652		
ain Clg	10.9	131.0	131.3	8,217	77.2 5	8.0 5	3.1	60.5	51.9	53.0	Part	1,360		
ux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	97		
pt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	3,652		0 0
otals	10.9	131.0									Wall	1,257		0 0
••••••	HEATING	COIL SELE	CTION		AI	RFLOWS (cfm)·			ENGINEERING	CHECKS	TEM	ERATURES	S (F)
	Capacity	Coil Ai	rfl Ent	Lvg	Type	Cooling	1	Heating		g % OA	10.0	Туре		
	(Mbh)	(cfm) Deg F	Deg F	Vent	822		822	CI	g Cfm/Sqft	2.25	SADB	61.7	_
ain Ktg	-83.7	8,2	17 65.4	76.0	Infil	198		198	_	g Cfm/Ton	752.90	Plenun		
ux Htg	0.0		0.0	0.0	Supply	8,217		8,217		g Sqft/Ton	334.62	Return		
reheat	-20.5	8,2	17 65.4	68.0	Mincfm	. 0		. 0		g Btuh/Sqft		Ret/OA		
eheat	0.0		0.0	0.0	Return	8,217		8,217		. People	13	Runarr		
umidif	0.0		0.0	0.0	Exhaust	822		822		g % OA	10.0	Fn Mtr		
pt Vent	0.0		0.0		Rm Exh	0		0		g Cfm/SqFt	2.25	Fn Blo		
otal	-83.7				Auxil	0		_		~		500		

System 3 Peak SZ - SINGLE ZONE

******	*****	*****	OOLING COIL	PEAK ****	*****	*****	****	*** CLG 5	SPACE	DEAK ****	***** HEA	TING COIL P	EAK **	*****
Peaked at			Mo/Hr:				*	Mo/1		/19 *	,,_,,	Mo/Hr: 13		
Outside A				,, 10 97/ 64/ 49.1	า		*		DB: 9			OADB: 2		
outside r		G 1.	55, 40, III.	,,, 0,, ,,,			*			*				
		Space	Ret. Air	Ret. Air	Net	Percnt	*	Spa	ace	Percnt *	Space Pe	ak Coil F	eak	Percnt
		Sens.+Lat.	Sensible			Of Tot	*	Sensil		Of Tot *	Space Ser			Of Tot
Envelope		(Btuh)	(Btuh)		(Btuh)	(%)	*	(Bt		(%) *	(Btul	h) (Bt	uh)	- (%)
Skylite		0	0		0	0.00	*		0	0.00 *		0	0	0.00
Skylite		0	0		0	0.00	*		0	0.00 *		0	0	0.00
Roof Co		0	0		0				0	0.00 *		0	0	0.00
Glass S		0	0		0				0	0.00 *		0	0	0.00
Glass (0	0		0	0.00			0	0.00 *		0	0	0.00
Wall Co		20,994	0		20,994	11.99		26,	280	17.31 *	-35,2	45 - 35,	245	35.78
Partiti		20,,,,	•		0			,	0	0.00 *		0	0	0.00
	d Floor	0			0	0.00			0	0.00 *	-4,5	-	502	4.57
Infilt		2,535			2,535	1.45		1.1	707	1.12 *	-5,0	-	034	5.11
Sub Tot		23,529	0		23,529			27,		18.43 *	-44,7			45.46
Internal		23,327	·		23,327	13.44	*	L.,	,0,	*	44,0			43140
Lights		20,977	0		20,977	11.98	*	20,	977	13.81 *		0	0	0.00
People		1,260			1,260			-	690	0.45 *		0	Ō	0.00
Misc		3,567	0	. 0	3,567				567	2.35 *		0	0	0.00
Sub Tot	tal==>	25,804	0		25,804			25,		16.62 *		0	0	0.00
Ceiling 1		25,004	0		25,00-	0.00			0	0.00 *		0	0	0.00
Outside /		0	0		27,06.	5.46			0	0.00 *		0 -53,	-	54.54
Sup. Fan		·	•	•	0				•	0.00 *		• • • • • • • • • • • • • • • • • • • •	0	0.00
Ret. Fan			0		0					0.00 *			0	0.00
			0		0					0.00 *			0	0.00
OV/UNDR S		98,639	•		98,639			98,	630	64.95 *		0	0	0.00
Exhaust I		70,037	0	. 0	0			,0,	037	0.00 *		•	0	0.00
Terminal			0		0					0.00 *			0	0.00
renminat	bypass				·	0.00	*			*			•	0.00
Grand To	tal==>	147,972	0	0	175,039	100.00	*	151,	860	100.00 *	-44,7	81 -98,	516	100.00
			coo	LING COIL S	ELECTION							AREAS		
	Total	Capacity	Sens Cap.	Coil Airfl	Enteri	ng DB/WB/	/HR	Leav	ing DB	/WB/HR	Gross Tot	al Glas	s (sf)	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	g F Grai	ins	Deg F	Deg F	Grains	Floor	2,090		
Main Clg	14.6	175.0	173.4	12,200	77.2 5	6.9 47	7.8	60.1	51.2	51.1	Part	0		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	131		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	0		0 0
Totals	14.6	175.0									Wall	2,140		0 0
	HEATI	NG COIL SEL	ECTION		A1	RFLOWS (cfm)-		E	NGINEERING	CHECKS	TEMPERA	TURES	(F)
	Capaci	ty Coil A	irfl Ent	Lvg	Туре	Cooling	H	leating	Clg	% OA	10.0	Type	Clg	Htg
	(Mbh) (cf	m) Deg F	Deg F	Vent	1,220		1,220	Clg	Cfm/Sqft	5.84	SADB	62.0	73.8
Main Htg	-130	.0 12,	200 62.7	73.8	Infil	114		114	Clg	Cfm/Ton	836.38	Plenum	75.0	70.0
Aux Htg	0	.0	0 0.0	0.0	Supply	12,200		12,200	Clg	Sqft/Ton	143.32	Return	75.0	70.0
Preheat	-0	.0 12,	200 65.4	60.1	Mincfm	0		0	Clg	Btuh/Sqft	83.73	Ret/OA	77.2	65.4
Reheat	0	1.0	0.0	0.0	Return	12,200		12,200	No.	People	3	Runarnd	75.0	70.0
Kumidif	0	0.0	0.0	0.0	Exhaust	1,220		1,220	Htg	% OA	10.0	Fn MtrTD	0.6	0.0
Opt Vent	0	0.0	0.0	0.0	Rm Exh	0		0	Htg	Cfm/SqFt	5.84	Fn BldTD	0.5	0.0
Total	-130	0.0			Auxil	0		0	Htg	Btuh/SqFt	-62.19	Fn Frict	1.5	0.0

V 600 PAGE 27

BUILDING U-VALUES - ALTERNATIVE 1
BASELINE BUILDING 23642

------ BUILDING U-VALUES-----

		Room U-Values									Room	Room
					(Btu	/hr/sqf	t/F)				Mass	Capac.
Room				Summr	Wintr		Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	NEW ADDITION - N	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	37.5	8.15
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	37.5	8.15
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	37.5	8.15
2	NEW ADDITION - S	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	39.4	8.53
Zone	2 Total/Ave.	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	39.4	8.53
System	2 Total/Ave.	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	39.4	8.53
3	ORIG. BLDG N	0.000	0.750	0.000	0.000	0.000	0.000	0.000	0.358	0.000	55.6	11.11
Zone	3 Total/Ave.	0.000	0.750	0.000	0.000	0.000	0.000	0.000	0.358	0.000	55.6	11.11
System	3 Total/Ave.	0.000	0.750	0.000	0.000	0.000	0.000	0.000	0.358	0.000	55.6	11.11
Buildin	g	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	42.2	8.96

BUILDING AREAS - ALTERNATIVE 1
BASELINE BUILDING 23642

Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)		Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	NEW ADDITION - 1	t 1	1	3,652	3,652	800	97	0	0	3,652	0	0	1,257
Zone	1 Total/Ave.				3,652	800	97	0	0	3,652	0	0	1,257
System	1 Total/Ave.				3,652	800	97	0	0	3,652	0	0	1,257
2	NEW ADDITION - S	s 1	1	3,652	3,652	1,360	97	0	0	3,652	0	0	1,257
Zone	2 Total/Ave.	•			3,652	1,360	. 97	0	0	3,652	0	0	1,257
System	2 Total/Ave.				3,652	1,360	97	0	0	3,652	0	0	1,257
3	ORIG. BLDG N	1	1	2,090	2,090	0	131	0	0	0	0	0	2,140
Zone	3 Total/Ave.				2,090	0	131	0	0	0	0	0	2,140
System	3 Total/Ave.				2,090	0	131	0	0	0	0	0	2,140
Buildir	ng				9,394	2,160	324	. 0	0	7,304	0	0	4,653

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 1
BASELINE BUILDING 23642

System Totals

| 機のことを含めているとのできる。 またい こうかん かいまた | 横っているので、 というには、これでは、これにいる。これには、またいという。

Percent	Cool	ing Loa	d	Heatin	ng Load		Cooling	Airflow			Heating	Airflow	••••
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours		Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)			(Cfm)	(%)	
	V								/				
0 - 5	1.8	19	754	-17,446	17	349	1,523.0	0	0	1357	0.0	0	0
5 - 10	3.6	13	518	-34,893	15	307	3,046.0	0	0	1862	0.0	0	0
10 - 15	5.4	10	389	-52,339	12	261	4,569.0	0	0	2101	0.0	0	0
15 - 20	7.2	7	278	-69,785	11	221	6,092.0	0	0	2007	0.0	0	0
20 - 25	9.0	9	353	-87,232	10	216	7,615.0	0	0	3177	10.0	0	0
25 - 30	10.9	9	358	-104,678	9	194	9,138.0	0	0	3002	0.0	0	0
30 - 35	12.7	9	373	-122,124	11	233	10,661.0	0	0	4737	0.0	0	0
35 - 40	14.5	5	187	-139,571	10	215	12,184.0	0	0	2712	0.0	0	0
40 - 45	16.3	8	319	-157,017	2	50	13,707.0	0	0	5200	0.0	0	0
45 - 50	18.1	4	171	-174,463	0	7	15,230.0	0	0	3095	0.0	0	0
50 - 55	19.9	5	213	-191,910	0	6	16,753.0	0	0	4239	0.0	0	0
55 - 60	21.7	2	65	-209,356	2	37	18,276.0	94	8,256	1411	0.0	0	0
60 - 65	23.5	1	45	-226,802	0	7	19,799.0	0	0	1058	0.0	0	0
65 - 70	25.3	0	20	-244,249	0	0	21,322.0	0	0	50%	0.0	0	0
70 - 75	27.1	0	0	-261,695	0	0	22,845.0	0	0		0.0	0	0
75 - 80	28.9	0	0	-279,141	0	0	24,368.0	0	0		0.0	0	0
80 - 85	30.8	0	0	-296,588	0	0	25,891.0	0	0		0.0	0	0
85 - 90	32.6	0	0	-314,034	0	0	27,414.0	0	0		0.0	0	0
90 - 95	34.4	0	0	-331,481	0	0	28,937.0	0	0		0.0	0	0
95 - 100	36.2	0	0	-348,927	0	0	30,460.0	6	504		0.0	0	0
Hours Off	0.0	0	4,717	0	0	6,657	0.0	0	0		0.0	0	8,760

37,362

----- MONTHLY ENERGY CONSUMPTION ------

	ELEC	DEMAND	GAS		GAS DMND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(kWh)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)
Jan	28,238	85	260	0	3
Feb	24,822	80	224	0	3
March	24,340	78	38	2	2
April	23,243	90	0	7	0
May	30,378	94	0	19	0
June	33,920	99	0	27	0
July	35,824	100	0	30	0
Aug	36,333	99	0	29	0
Sept	29,643	96	0	18	0
0ct	24,715	90	0	7	0
Nov	23,321	78	60	1	2
Dec	26,730	78	162	0	2
Total	341,507	100	744	139	3

Building Energy Consumption =

131,991 (Btu/Sq Ft/Year) Source Energy Consumption = 132,236 (Btu/Sq Ft/Year)

Floor Area =

9,394 (Sq Ft)

Monthly KW = 1,067

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

******************************	 DEAY	C H E C K S U M S
	 PEAN	CHECKSUMS

Utility ELECTRIC DEMAND

Peak Value 99.8 (kW)
Yearly Time of Peak 10 (hr) 7 (mo)

Hour 10 Month 7

Eqp.	r:		Utility	
Ref.	Equipment		Demand	Of Tot
Num.	Code Name	Equipment Description	(kW)	(%)
Cooling E	quipment			
1	EQ1070L	WTR-CLD RECIP >30 TONS	36.9	36.96
Sub Total			36.9	36.96
Sub Total			0.0	0.00
Air Moving	g Equipment			
1		SUMMATION OF FAN ELECTRICAL DEMAND	7.5	7.52
2		SUMMATION OF FAN ELECTRICAL DEMAND	7.5	7.52
3		SUMMATION OF FAN ELECTRICAL DEMAND	18.6	18.65
Sub Total			33.6	33.68
Sub Total			0.0	0.00
Miscelland	eous			
Lights			24.6	24.65
Base Uti	lities		0.0	0.00
Misc Equ	ipment		4.7	4.71
Sub Total			29.3	29.36
Grand Tota	at		99.8	100.00

ESOS STUDY AT WSMR - BUILDING 23642
WHITE SANDS MISSILE RANGE NM
US ARMY
EMC ENCLUSEDS INC

EMC ENGINEERS, INC.

BLDG AUDIT PER SON: ALT 1-BSLN, ALTZ-ECO (MODIFIED CONFIGURATION)

Weather File Code: ELPASO.W

Location:
Latitude: 31.0 (deg)
Longitude: 106.0 (deg)
Time Zone: 6

Elevation: 3,918 (ft)
Barometric Pressure: 25.8 (in. Hg)

Summer Clearness Number: 1.00
Winter Clearness Number: 1.00
Summer Design Dry Bulb: 98 (F)
Summer Design Wet Bulb: 64 (F)
Winter Design Dry Bulb: 24 (F)
Summer Ground Relectance: 0.20
Winter Ground Relectance: 0.20

: មានប្រជុំព្យា ورززون

Air Density: 0.0653 (Lbm/cuft)
Air Specific Heat: 0.2444 (Btu/lbm/F)

Density-Specific Heat Prod: 0.9575 (Btu-min./hr/cuft/F)
Latent Heat Factor: 4,214.8 (Btu-min./hr/cuft)
Enthalpy Factor: 3.9171 (Lb-min./hr/cuft)

Design Simulation Period: January To December
System Simulation Period: January To December
Cooling Load Methodology: TETD/Time Averaging

Time (Date Program to 2 Pure 2017)

Time/Date Program was Run: 9:36:21 6/19/92 Dataset Name: 23642 .TM 1555157434

- SINGLE ZONE System Peak Mo/Hr: 13/ 1 Mo/Hr: 6/16 Mo/Hr: 7/16 Peaked at Time ==> OADB: 24 OADB: 97 OADB/WB/HR: 97/ 64/ 49.0 Outside Air ==> Coil Peak Percnt Percnt * Space Peak Net Percnt Space Ret. Air Ret. Air Space Of Tot Space Sens Tot Sens **Sensible** Of Tot Total Of Tot Sens.+Lat. Sensible Latent (Btuh) (%) (Btuh) (Btuh) (%) (%) (Bţuh) (Btuh) (Btuh) (Btuh) Envelope Loads 0.00 0 0.00 0.00 0 0 0 Skylite Solr 0 0.00 0 0 0.00 0.00 0 0 Skylite Cond 0 -23,519 30.31 -23,519 50.91 44,277 43,919 39.79 0 Roof Cond 43,919 0.00 0 0 0.00 0 0 0.00 0 0 Glass Solar 0 0 0.00 0.00 0.00 0 0 0 0 Glass Cond -20,693 -20,693 26.67 9,672 11.12 9.05 9,987 9,987 0 Wall Cond 0.00 0 0 0.00 0 0 0.00 Partition 0 4.30 -3,334 0.00 -3,334 0 0 0.00 0 Exposed Floor -8,713 -8,713 11.23 4.86 3.94 4,224 4,349 4,349 Infiltration -56,260 -56,260 72.51 66.89 58,173 52.78 58,255 0 Sub Total==> 58,255 Internal Loads 0 0 0.00 22.50 19,569 19,569 17.73 19,569 0 Lights 0 0.00 3.44 2,990 5,460 4.95 5,460 People 0 0.00 6,232 7.17 6,232 5.65 0 6,232 Misc 0.00 0 33.11 28,791 31,261 28.32 O 0 31,261 Sub Total ==> O 0.00 0 0.00 0 0 0.00 0 0 Ceiling Load -28,145 36.28 0.00 14,048 12.73 0 0 0 Outside Air 6,817 -8.79 0.00 6,817 6.18 Sup. Fan Heat 0.00 0.00 0.00 0 0 Ret. Fan Heat 0.00 0.00 0.00 0 0 Duct Heat Pkup 0.00 0.00 0.00 0 0 OV/UNDR Sizing 0 0.00 0.00 0.00 0 0 n Exhaust Heat 0.00 0 0.00 0.00 0 0 Terminal Bypass -77,587 100.00 -56,260 100.00 110.380 100.00 86,964

				-ເຕດ	ING COIL S	ELECTION							AREAS				
	Total C	apacity	Sens C		Coil Airfl			B/WB/HR		ving DB	/WB/HR	Gross To	tal Gl	ass ((sf)	(%)
	(Tons)	(Mbh)	(Mbh	•	(cfm)	Deg F	Deg F	Grains	Deg F	Deg F	Grains	Floor	3,652				
Main Clg	9.2	110.4	107	-	6,391	77.2	56.9		59.7	50.1	47.1	Part	800				
Aux Clg	0.0	0.0		.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Exflr	97				
Opt Vent	0.0	0.0		.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	3,652		0		0
Totals	9.2	110.4	Ţ									Wall	1,257		0)	0
Main Htg Aux Htg Preheat Reheat Humidif	Capacity (Mbh) -77.6 0.0 -15.9 0.0	(cf 6,	irfl m) D 391 0 391 0	eg F 65.4 0.0 65.4 0.0	Lvg Deg F 78.1 0.0 68.0 0.0	Type Vent Infil Supply Mincfm Return Exhaust	Co	DWS (cfm oling 639 198 6,391 0 6,391 639	Heating 639 198 6,391 0 6,391 639	Cig Cig Cig Cig No.	NGINEERING	10.0 1.75 694.80 397.03	TEMPE Type SADB Plenum Return Ret/OA Runarno Fn Mtri	Ci 64 73 77 77 71 70	RES (lg 0.8 5.0 5.0 7.2 5.0 0.2	Ht 79 70 70 65 70	
Opt Vent Total	0.0 -77.6		0	0.0	0.0	Auxil		0	0		Btuh/SqFt		Fn Fric	:t	8.0	0	0.0

Ret/OA

Runarnd

Fn MtrTD

Fn BldTD

Fn Frict

31.61

13

10.0

1.75

-21.25

77.2

75.0

0.2

0.3

8.0

65.4

70.0

0.0

0.0

0.0

-15.9

0.0

0.0

0.0

-77.6

Preheat

Reheat

Humidif

Opt Vent

Total

6,391

0

65.4

0.0

0.0

0.0

68.0

0.0

0.0

0.0

Mincfm

Return

Exhaust

Rm Exh

Auxil

abiotification

System 2 Peak SZ - SINGLE ZONE

Peaked at		=>	Mo/Hr	: 7	7/16			1	Mo	/Hr:	7/17 *	****** HEATI	Mo/Hr: 13/	1	
Outside A	ir ==>	0	ADB/WB/HR	: 9	97/ 64/ 49.0	1		,	• c	ADB:	96 *		OADB: 24	•	
		Space	Ret.	Air	Ret. Air	N	et l	Percnt 1	· s	pace	Percnt *	Space Peak	Coil Pe	ak	Percnt
	. :	Sens.+Lat.	Sensi		Latent	Tot		Of Tot		ible	Of Tot *	Space Sens	Tot Se	:ns	Of Tot
Envelope ((Btuh)		uh)	(Btuh)	(Btu		(%)	· (B	tuh)	(%) *	(Btuh)	(Btu	h)	(%)
Skylite		0	-	0	•		0	0.00	t .	0	0.00 *	0		0	0.00
Skylite		0		0			0	0.00	+	0	0.00 *	0		0	0.00
Roof Co		43,919		0		43,9	19	38.04	42	,027	44.00 *	-23,519	-23,5	19	30.31
Glass S		0		0		•	0	0.00	t	0	0.00 *	0		0	0.00
Glass C		0		0			0	0.00	t	0	0.00 *	0		0	0.00
Wall Co		11,201		0		11,2	01	9.70	13	406	14.03 *	-20,693	-20,6	93	26.67
Partiti		0		·		* - •	0	0.00	t	Ō	0.00 *	0		0	0.00
Exposed		0					0	0.00	+	0	0.00 *	-3,334	-3,3	34	4.30
Infiltr		3,523				3,5	-	3.05	. 3	,940	4.12 *	-8,713			11.23
Sub Total		58,643		0		58,6		50.79		.373	62.16 *	-56,260	-56,2	260	72.51
Internal		20,043		·		20,0		1	.	•	*	·	·		
Lights	Luaus	26,923		0		26,9	23	23.32	26	,923	28.19 *	0		0	0.00
People		5,460		·		5,4		4.73		,990	3.13 *	0		0	0.00
Misc		6,232		0	0	6,2		5.40		,232	6.52 *	0		0	0.00
Sub Tota	al ==>	38,615		0	0	38,6		33.45		,145	37.84 *	0		0	0.00
Ceiling L		0,013		0	•	,-	0	0.00		0	0.00 *	0		0	0.00
.Outside A	_	. 0		0	0	. 11,3	-	9.86	t .	0	0.00 *	0	-28,1	45	36.28
Sup. Fan				•	•	6,8		5.90			0.00 *		6,8	317	-8.79
Ret. Fan				0		0,0	0	0.00			0.00 *			0	0.00
Duct Heat				0			0	0.00	k		0.00 *			0	0.00
OV/UNDR S		0		٠			o	-0.00	k	0	-0.00 *	0		0	0.00
•	_	·		0	0		0	0.00	k	•	0.00 *			0	0.00
Exhaust H				0			0	0.00	k		0.00 *			0	0.00
Terminal	bypass			Ü	·		•	,	k .		*				
Grand Tota	al==>	97,258		0	0	115,4	56	100.00	· 95	,518	100.00 *	-56,260	-77,5	87	100.00
				COO	LING COIL SE	LECTION-									
	Total	Capacity	Sens Ca	p.	Coil Airfl	Ente	ring	DB/WB/H		_	DB/WB/HR	Gross Total		s (sf) (%)
	(Tons)	(Mbh)	(Mbh)	1	(cfm)	Deg F	Deg	F Grain	s Deg F	Deg	F Grains	Floor 3	,652		
Main Clg	9.6	115.5	116.	0	6,391	77.2	58.	3 54.	58.3	51.		Part 1	,360		
Aux Clg	0.0	0.0	0.	0	0	0.0	0.	0 0.	0.0	0.	0.0	ExFlr	97		
Opt Vent	0.0	0.0	0.	0	0	0.0	0.	0 0.	0.0	0.	0.0		,652		0 (
Totals	9.6	115.5										Wall 1	,257		0 (
	HEATI	NG COIL SE	LECTION				AIRF	LOWS (cf	n)		-ENGINEERING		TEMPERAT		
	Capaci	ty Coil	Airfl E	nt	Lvg	Type	C	ooling	Heating		lg % OA	10.0	• •	Clg	Htg
	(Mbh) (c	fm) De	g F	Deg F	Vent		639	639		lg Cfm/Sqft		SADB	59.4	
Main Htg	-77	.6 6	,391 6	5.4	78.1	Infil		198	198	3 0	lg Cfm/Ton	664.25	Plenum	75.0	
Aux Htg	0	.0	0	0.0	0.0	Supply		6,391	6,391	0	lg Sqft/Ton	379.57	Return	75.0	70.0

0

639

0

0

6,391

0

6,391

639

0

0

Clg Btuh/Sqft

Htg Cfm/SqFt

Htg Btuh/SqFt

No. People

Htg % OA

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System 3 Peak SZ - SINGLE ZONE

Peaked at	Time ==>		Mo/Hr:				•	Mo/H		7/19 *		Mo/Hr: 1	-	
Outside Ai	ir ==>	DAD	B/WB/HR:	97/ 64/ 49.	0		*	OAD	OB: 9)1		OADB:	24	
			D-4 42	- Dat 1:-	Not	Percnt	*	Sne	ace	Percnt *	Space Per	ak Coil	Peak	Percnt
	•	Space		r Ret. Air	Total	Of Tot	*	Sensib		Of Tot *			Sens	Of Tot
		ns.+Lat.	Sensible	_	(Btuh)	(%)	*	(Btu		(%) *	(Btu		Stuh)	(%)
Envelope L		(Btuh)	(Btuh) (Btuh))	(6141)	0.00		(010	0	0.00 *	-	0	0	0.00
Skylite		0)]	0	0.00			0	0.00 *		0	0	0.00
Skylite		0)	0	0.00			0	0.00 *		0	0	0.00
Roof Cor		0)	0	0.00			0	0.00 *		0	0	0.00
Glass So		0)	0	0.00			0	0.00 *		0	0	0.00
Glass Co)]	20,994	37.34		26,2	_	57.72 *		45 -35	,245	57.87
Wall Cor		20,994		,	20,774	0.00		20,0	0	0.00 *		0	. 0	0.00
Partitio		0			0	0.00			0	0.00 *	-4,5		,502	7.39
Exposed		0	•		~			4 7	707	3.75 *			5,034	8.27
Infiltra		2,446		_	2,446	41.70		27,9		61.47 *			781	73.53
Sub Tota		23,439	4	0	23,439	41.70	*	21,1	701	*			.,	
Internal l	Loads			_	4/ 2/0	20.0/		44.5	240	35.73 *		0	0	0.00
Lights		16,268	1	0	16,268			16,2	590	1.52 *		0	0	0.00
People		1,260			1,260							0	0	0.00
Misc		3,567		0	3,567				567			0	0	0.00
Sub Tota		21,095		0	21,095	37.53		20,5				0	o	0.00
Ceiling Lo		0)	0	0.00			0	0.00 *		-	5,121	26.47
Outside Ai		0		0	7,832	13.93			U	0.00 *		• "	0	0.00
Sup. Fan l				_	6,828	12.15				0.00 *			0	0.00
Ret. Fan l				D •	0					0.00			Ö	0.00
Duct Heat			,	0	3.070			-2,9	070	-6.54 *		0	0	0.00
OV/UNDR S	_	-2,979			-2,979 0			2,1	,,,	0.00 *		•	0	0.00
Exhaust He				0 0	0					0.00			0	0.00
Terminal 6	Bypass			0	U	0.00				*			•	
Grand Tota	a(==>	41,555	í	0	56,216	100.00	*	45,5	533	100.00	-44,7	81 -60	901	100.00
			со	OLING COIL S	ELECTION							AREAS		
	Total C	apacity	Sens Cap.	Coil Airfl	Enteri	ng DB/WB	/HR			B/WB/HR	Gross Total		ass (st	f) (%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F De	g F Gra	ins	-	-	Grains	Floor	2,090		
ain Clg	4.7	56.2	55.6	3,658	77.2 5	7.1 4	8.9	60.1	51.1	50.6	Part	0		
ux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Exflr	131		
pt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	0		0 0
otals	4.7	56.2									Wall	2,140		0 0
	HEATING	COIL SELI	ECTION		AI					ENGINEER ING		TEMPE		
	Capacity			Lvg	Type	Cooling		Heating		% OA	10.0	Туре	Clg	Htg
	(Mbh)	(cf			Vent	366		366		Cfm/Sqft	1.75	SADB	62.0	
lain Htg	-130.0	3,0	558 45.		Infil	114		114		Cfm/Ton	780.85	Plenum	75.0	
ux Htg	0.0		0 0.		Supply	3,658		3,658		Sqft/Ton	446.25	Return	75.0	
reheat	-0.0	3,0	658 65.	4 60.1	Mincfm	0		0		g Btuh/Sqft		Ret/OA	77.3	
eheat	0.0)	0 0.	0.0	Return	3,658		3,658		. People	3	Runarnd	75.0	
umidif	0.0)	0 0.	0.0	Exhaust	366		366		3 % OA	10.0	Fn MtrTl		
pt Vent	0.0)	0 0.	0.0	Rm Exh	0		0	Hts	g Cfm/SqFt	1.75	Fn BldTi		
otal	-130.0				Auxil	0		0	44.	Btuh/SqFt	-62.19	Fn Fric	t 1.9	5 0.0

BUILDING U-VALUES - ALTERNATIVE 2 ECO - 23642

------ BUILDING U-VALUES-----

						Room Mass	Room Capac.					
Room				Summr	Wintr	•	Summr	Wintr			(lb/	(Btu/
Number	Description	Part.	ExFlr	Skylt	Skylt	Roof	Windo	Windo	Wall	Ceil.	sqft)	sqft/F)
1	NEW ADDITION - N	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	37.5	8.15
Zone	1 Total/Ave.	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	37.5	8.15
System	1 Total/Ave.	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	37.5	8.15
2	NEW ADDITION - S	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	39.4	8.53
Zone	2 Total/Ave.	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	39.4	8.53
System	2 Total/Ave.	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	39.4	8.53
3	ORIG. BLDG N	0.000	0.750	0.000	0.000	0.000	0.000	0.000	0.358	0.000	55.6	11.11
Zone	3 Total/Ave.	0.000	0.750	0.000	0.000	0.000	0.000	0.000	0.358	0.000	55.6	11.11
System	3 Total/Ave.	0.000	0.750	0.000	0.000	0.000	0.000	0.000	0.358	0.000	55.6	11.11
Buildin	g	0.388	0.750	0.000	0.000	0.140	0.000	0.000	0.358	0.000	42.2	8.96

BUILDING AREAS - ALTERNATIVE 2 ECO - 23642

------ BUILDING AREAS -----

Room Number	Description		er of icate Rm	Floor Area/Dupl Room (sqft)	Total Floor Area (sqft)	Partition Area (sqft)	Exposed Floor Area (sqft)	Skylight Area (sqft)	Skl /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
1	NEW ADDITION - N	1	1	3,652	3,652	800	97	0	0	3,652	0	0	1,257
Zone	1 Total/Ave.				3,652	800	97	0	0	3,652	. 0	0	1,257
System	1 Total/Ave.				3,652	800	97	0	0	3,652	0	0	1,257
2	NEW ADDITION - S	1	1	3,652	3,652	1,360	97	0	0	3,652	0	0	1,257
Zone	2 Total/Ave.				3,652	1,360	97	0	0	3,652	0	0	1,257
System	2 Total/Ave.				3,652	1,360	97	0	0	3,652	0	0	1,257
3	ORIG. BLDG N	1	1	2,090	2,090	0	131	0	0	0	0	0	2,140
Zone	3 Total/Ave.				2,090	0	131	0	0	0	0	0	2,140
System	3 Total/Ave.				2,090	0	131	0	0	0	0	0	2,140
Buildin	g				9,394	2,160	324	0	0	7,304	0	0	4,653

SYSTEM TOTALS LOAD PROFILE - ALTERNATIVE 2 ECO - BUILDING 23642

System Totals

Percent	Cool	ling Loa	id	Heati	ng Load	•••••	Cooling	Airflow		Heating	Airflow	
Design	Cap.	Hours	Hours	Capacity	Hours	Hours	Cap.	Hours	Hours	Cap.	Hours	Hours
Load	(Ton)	(%)		(Btuh)	(%)		(Cfm)	(%)		(Cfm)	(%)	
0 - 5	1.2	18	705	-15,849	15	389	822.0	0	0	0.0	0	0
5 - 10	2.4	12	486	-31,699	15	377	1,644.0	0	0	0.0	0	0
10 - 15	3.5	7	294	-47,548	13	338	2,466.0	0	0	0.0	0	0
15 - 20	4.7	7	260	-63,397	13	326	3,288.0	0	0	0.0	0	0
20 - 25	5.9	4	174	-79,247	12	305	4,110.0	0	0	0.0	0	0
25 - 30	7.1	5	193	-95,096	10	251	4,932.0	0	0	0.0	0	0
30 - 35	8.2	4	165	-110,945	10	260	5,754.0	0	0	0.0	0	0
35 - 40	9.4	6	243	-126,795	8	207	6,576.0	0	0	0.0	0	0
40 - 45	10.6	3	117	-142,644	2	42	7,398.0	0	0	0.0	0	0
45 - 50	11.8	5	200	-158,494	2	48	8,220.0	0	0	0.0	0	0
50 - 55	12.9	4	155	-174,343	0	0	9,042.0	0	0	0.0	0	0
55 - 60	14.1	3	126	-190,192	0	0	9,864.0	0	0	0.0	0	0
60 - 65	15.3	5	195	-206,042	0	0	10,686.0	0	0	0.0	0	0
65 - 70	16.5	6	248	-221,891	0	0	11,508.0	0	0	0.0	0	0
70 - 7 5	17.6	3	127	-237,740	0	0	12,330.0	0	0	0.0	0	0
75 - 80	18.8	2	83	-253,590	0	0	13,152.0	63	5,562	0.0	0	0
80 - 85	20.0	2	91	-269,439	0	0	13,974.0	0	0	0.0	0	0
85 - 90	21.2	. 2	62	-285,288	0	0	14,796.0	6	504	0.0	0	0
90 - 95	22.3	1	59	-301,138	0	0	15,618.0	0	0	0.0	0	0
95 - 100	23.5	0	0	-316,987	0	0	16,440.0	31	2,694	0.0	0	0
Hours Off	0.0	0	4,777	0	0	6,217	0.0	0	0	0.0	0	8,760

ห์หัสสุดสิทธิ์การ - เกียกสุดสิทธิ์การ

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2

-MONTHLY ENERGY (C O N S U M P T I O N
-------------------	-----------------------

	ELEC	DEMAND	GAS		GAS DMND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(kWh)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)
Jan	24,528	55	282	0	1
Feb	21,397	55	222	0	1
March	19,691	66	84	0	1
April	18,669	70	0	5	1
May	25,075	71	0	16	0
June	28,795	73	0	24	0
July	31,119	75	0	28	0
Aug	31,074	74	0	27	0
Sept	25,105	71	0	16	0
Oct	19,753	70	0	5	1
Nov	19,362	66	105	0	1
Dec	22,937	55	185	0	1
Total	287,506	75	878	123	1

Building Energy Consumption = Source Energy Consumption =

113,801 (Btu/Sq Ft/Year) 114,090 (Btu/Sq Ft/Year)

Floor Area =

9,394 (Sq Ft)

Z Monthly KW = 801

-----UTILITY PEAK CHECKSUMS-----

Util	itv	ELECTRIC	DEMAND
ULIL	1 4 7	FFFFILT	DEIMAN

74.7 (kW) Peak Value Yearly Time of Peak 16 (hr) 7 (mo)

Hour 16 Month 7

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Eqp.			Utility	Percnt
Ref.	Equipment		Demand	Of Tot
Num.	Code Name	Equipment Description	(kW)	(%)
Cooling Ed	quipment			
1	EQ1070L	WTR-CLD RECIP >30 TONS	34.8	46.59
Sub Total			34.8	46.59
Sub Total			0.0	0.00
Air Moving	g Equipment			
1		SUMMATION OF FAN ELECTRICAL DEMAND	5.6	7.50
2		SUMMATION OF FAN ELECTRICAL DEMAND	5.6	7.50
3		SUMMATION OF FAN ELECTRICAL DEMAND	5.6	7.50
Sub Total			16.8	22.50
Sub Total			0.0	0.00
Miscelland	eous			
Lights			18.4	24.62
Base Uti	lities		0.0	0.00
Misc Equi	ipment		4.7	6.29
Sub Total			23.1	30.91
Grand Tota	al		74.7	100.00

TAB 20 TABLE OF CONTENTS

TECH AREA CHILLER PLANT

TAB 20 Baseline Data

- Utility Cost Summary
- TRACE 600 Report on Consolidated Loads Individual Building TRACE Reports
- Hand Calculations of Consolidated Monthly Loads

TAB 21 ALT 1 Data

TAB 22 ALT 2 Data

TAB 23 ALT 3 DAta

TAB 24 ALT 4 Data

Economic Summary

FROM TRACE 600 RUNS UN ALT#1 E ALT#2

MONTHLY MAXIMUM ON PEAK FLEC, DEMAND (KW)

CHW PUMP COND, WATER CHILLERS SUM OF MUNTHLY PUMP COOLING YOURN ON PEAK KW 3,831

ALT#2 471.6 0 0 1,214

PROM TRACE

MONTHLY AND

ANNUAL WILLTY

REPORT SUMMANGE

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

TECH AREA BASELINE ELECTRICAL USAGE

JOB WS MIR JESOS STUNY	# 1110-000
SHEET NO.	
CALCULATED BY	DATE
CHECKED BY	DATE
SCALE	

FROM INDIVIDUAL BLAG TRACE 600 RUNS:

BLD6.	ICW H	Z KW	GAS.
b 120p	655,601	3,707	77611
P1512	1,286,045	2,809	66.6
P1526	1,043,946	2,283	674,5
P1528	543,627	1,420	298.1
P 1530	1,002,336	3,070	922.2
D1651	302,686	971	96,2
P1622/23	992,994	2,709	881,0
P1624	855, 490	2,710	100,2
TOTAL	6,682,725	19,679	3,815

	JOB	
	SHEET NO.	_ OF
E M C ENGINEERS, INC.	CALCULATED BY Alan Weneyer	DATE 4-1-92
Denver • Colorado Springs • Atlanta • Germany	0	
TECH CENTER EQUIPMENT REPLACEMENT	CHECKED BY	_ DATE
& MAINTENANCE COST SUMMARY	SCALE	

TECH CENTER BASELINE REPLACEMENT COST SUMMARY:

YEAR 1 : \$ 100,000

YEAR 5: \$193,500

YEAR 10: \$713,250

TECH CENTER BASELINE MAINTENANCE COST SUMMARY:

YEAR 1 . \$ 3,000

YEAR 5: \$ 5,805

YEAR 10: #21,398

	RECURRING	NON-RECURRING COSTS		
#TEM	MAINT. COST (\$/yR)	YEAR OF REPLACEMENT	REPLACEMENT COST (#)	MAINTENANCE COST (1)
BASELINE	30,203	1	- 100,000	3,000
		5	193,500	5,805
		10	7/3,250	21,398
ALT 1		1	, 0	50,420
ALT 2		1	2 0 1	71,346
ALT 3		1	0	126,574
ALT 4)	/ _	/31,786

DIFFERENTIAL COSTS (BASELINE - ALTERNATIVE)

	RECURRING	NON RECURRING COSTS		
ITEM	C0373	YEAR	#	
ALT 1	-20217	1	100,000	
Central Chiller	-20,217	5	193,500	
Plant		/0	7/3,250	
Central Chiller	-41,143	5	-100,000 + 167,960 = 267,960 193,250	
PET WITHERM Store		10 -	713,250	
AITZ		,	100,000	
Control Chilber	- 96,371	3	193,500 -	
Att/Cogen Ptt/Cent		10	7/3,250	
		/	+/00,000	
ALT 4 Central Childer PLI Cogen. PLT (Absorption)	-101,583	10D20-4	193,500 713,500	

* Utility Rebate for KW Shift: 884KW X \$190 = \$167,960

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----- MONTHLY ENERGY CONSUMPTION------

ELEC DEMAND GAS GAS DMND On Peak On Peak On Peak On Peak Month (kWh) (kW) (Therm) (Thrm/hr) 44,083 124 2,743 Feb 39,818 124 1,990 44,604 147 423 March April 45,290 0 166 61,279 203 0 May 71,830 220 June 0 78,442 223 July 77,510 220 0 Aug 60,425 201 Sept 0 0ct 47,842 182 41,083 123 623 Nov 1,982 43,395 124 Dec

Building Energy Consumption =
Source Energy Consumption =

655,601

Total

87,746 (Btu/Sq Ft/Year) 88,444 (Btu/Sq Ft/Year)

7,761

Floor Area = 34,346 (Sq Ft)

Z monthly KW= 3,707

223

------ MONTHLY ENERGY CONSUMPTION ---------

MONTHLY ENERGY CONSUMPTION BASELINE

	ELEC	DEMAND	GAS		GAS DHND
	On Peak	On Peak	On Peak	WATER	On Peak
Honth	(kWh)	(kii)	(Therm)	(1000 GL)	(Thrm/hr)
	of 7/7	202	070	-	,

*******	V	••	((,,,	***************************************
net	85,767	202	270	3	4
Feb	78,782	203	165	5	3
March	96,605	213	31	21	2
April	100,600	232	0	38	0
Hay	122,311	238	0	69	0
June	127,978	241	0	89	0
July	131,267	246	0	101	0
Aug	135,338	245	0	100	0
Sept	122,125	240	0	72	0
Oct	109,669	233	0	43	Q
Nov	89,264	209	40	19	3
Dec	86.340	207	160	7	3

Building Energy Consumption = Source Energy Consumption =

1,286,045

Total

111,440 (8tu/Sq Ft/Year) 111,492 (8tu/Sq Ft/Year) Floor Area =

39,984 (Sq Ft)

2 monthly KW = 2,809

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Trane Air Conditioning Economics

By: Trane Customer Direct Service Network

BLOG. 1526

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MONTHLY ENERGY CONSUMPTION - BASELINE

	ELEC	DEMAND	GAS	GAS DHND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(ku)	(Therm)	(Thrm/hr)
Jan	77,804	146	2,257	8
Feb	70,197	146	1,664	7
March	78,873	165	512	4
April	79,731	187	0	- 1
May	93,682	214	٥	0
June	99,7 95	237	0	0
July	109,089	242	0	0
Aug	107,256	238	Q	0
Sept	92,024	215	0	O
Oct	82,722	186	0	0
Nov	75,203	161	680	4
Dec	77,570	146	1,631	5
Total	1,043,946	242	6,745	8

Building Energy Consumption = Source Energy Consumption =

172,563 (8tu/Sq Ft/Year) 173,412 (8tu/Sq Ft/Year) Floor Area = 24,556 (Sq Ft)

E monthly KW= 2,283

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MONTHLY ENERGY CONSUMPTION - BASELINE

BLOG. 1528

	ELEC	DEMAND	GAS		GAS DHND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(kWh)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)
Jan	36,905	109	821	11	3
Feb	32,836	112	641	11	3
March	41,217	111	312	23	2
April	42,815	120	55	30	1
Kay	50,662	121	0	50	0
June	54,427	124	0	61	0
July	56,045	127	0	71	0
Aug	58,273	126	0	71	0
Sept	50,726	123	0	53	0
Oct	46,242	118	97	34_	_ 1
Nov	36,863	110	376	18	2
Dec	36,616	109	679	13	3
Total	543,627	127	2,981	445	3

Suilding Energy Consumption = Source Energy Consumption =

86,742 (Btu/Sq Ft/Year) 87,113 (Btu/Sq Ft/Year) Floor Area = 24

24,827 (Sq Ft)

E monthly KW= 1,420

03000000000

Source Energy Consumption =

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 BLDG 1530 BASELINE

	ELEC	DEMAND	GAS	GAS DMND		
	On Peak	On Peak	On Peak	On Peak		
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)		
Jan	75,189	209	3,756	11		
Feb	68,225	209	2,559	10		
March	74,803	203	217	5		
April	68,489	230	0	0		
May	87,489	289	0	0		
June	107,842	330	0	0		
July	111,255	335	0	0		
Aug	112,459	325	0	0		
Sept	83,340	284	0	0		
0ct	72,773	244	0	0		
Nov	68,148	203	374	5		
Dec	72,323	209	2,316	8		
Total	1,002,336	335	9,222	11		
Total Building Energy				•	•	•
Source Energy		- 55,10		rt/rear)	Floor Area =	81,68

2 monthly LW= 3,070

53,516 (Btu/Sq Ft/Year)

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MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

------ MONTHLY ENERGY CONSUMPTION ------

BOWN, FRANK SARELVE

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(kWh)	(kW)	(Therm)	(Thrm/hr)
Jan	19,305	57	452	3
Feb	17,232	57	272	2
March	19,595	54	0	1
April	24,428	99	0	0
May	34,860	115	0	0
June	40,919	135	0	0
July	43,200	135	0	0
Aug	42,438	133	0	0
Sept	33,339	110	0	0
0ct	25,706	97	0	0
Nov	17,784	54	4	1
Dec	18,741	57	234	2
Total	337,547	135	962	3

Building Energy Consumption = Source Energy Consumption =

63,554 (Btu/Sq Ft/Year) 63,705 (Btu/Sq Ft/Year) Floor Area =

19,641 (Sq Ft)

Emonthly kw= 971

8.1622-23

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MONTHLY ENERGY CONSUMPTION - BASEUNE

M O N T H I Y	ENEDCY	CONSUMPTION
		COM 2 UM P 1 UN

	ELEC	DEMAND	GAS	GAS DMND
	On Peak	On Peak	On Peak	On Peak
Month	(k\h)	(kW)	(Therm)	(Thrm/hr)
Jan	73,978	188	3,235	9
Feb	66,893	188	2,316	9
March	75,090	188	309	4
April	69,732	186	0	0
May	89,759	260	0	0
June	99,677	285	0	0
July	105,737	288	0	0
Aug	105,207	282	0	0
Sept	85,990	246	0	0
0ct	76,251	222	0	0
Nov	71,352	188	654	5
Dec	73,327	188	2,297	7
Total	992,994	288	8,810	9

Building Energy Consumption = Source Energy Consumption =

113,678 (Btu/Sq Ft/Year) 114,404 (Btu/Sq Ft/Year)

Floor Area =

37,563 (Sq Ft)

E monthly kw= 2,709

BLOG. 1624

MONTHLY ENERGY CONSUMPTION - BASELINE

 Ħ	0	N	1	Н	L	Y	Ε	N	Ε	R	G	Y	С	0	N	S	U	М	Ρ	T	I	0	М	

	ELEC	DEMAND	GAS		GAS DMND
	On Peak	On Peak	On Peak	WATER	On Peak
Month	(kWh)	(kW)	(Therm)	(1000 GL)	(Thrm/hr)
Jan	46,224	158	520	0	6
Feb	41,749	201	281	0	6
March	57 <i>,</i> 73 1	220	0	20	0
April	68,501	233	0	48	0
May	88,392	241	0	94	0
June	94,585	249	0	122	0
July	97,242	254	0	138	0
Aug	100,590	252	0	135	0
Sept	88,716	243	0	97	0
Oct	74,689	234	0	53	0
Nov	50,767	219	0	15	0
Dec	46,304	206	200	2	4
Total	855,490	254	1,002	724	6

Building Energy Consumption =

73,520 (Btu/Sq Ft/Year)

Floor Area = 41,076 (Sq Ft)

Source Energy Consumption = 73,596 (Btu/Sq Ft/Year)

Emonthly Kw= 2,710

ដាម៉ូនជាជា

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TECH ARGA ITEMPING

LOAD CALCS

JOB WSUL ESOS STUDY	#1110-000
SHEET NO.	OF <u>5</u>
-	DATE 3/37/91
CHECKED BY	DATE
SCALE	

			FT. R	LISS	m' pr	ī 4	P	sase =	50°F	
△	TEMP .	Jan	Teb.	.MAR	APR	OCT	Non	DEC	HAS	
	Section 1. Control of the control of	- , , , , , , , , , , , , , , , , , , ,	-,Hou	rs; of	OBSERVA	וואסון		→		
2.5	45-49	113	101	94	41	35	109	114	607	
7,5	40-44	113	87	6 3	15	13	95	114	500	
12.5	35-39	103	73	43	ſ	1	64	109	39.4	
17.5	30-34	75	50	20			30	90	265	
22.5	25-29	43	27	9			ر 3،	43	132	
27.5	20-24	21	12	1			2	14	ક્ષ્	
32.5	15-19	\$	6					- 3	17.	
37.5	10-15	4	1					1	6	
42.5	5-9	2							2	
	TOT,	482	357	230	57	49	313	488	1976	
H	. DD :	140	161	76	/0	9	/11	241	6 48 = TOT HD	

FROM TRAVE TRACE SIMULATIONS OF BLOGS IN THE TECH AREA,

THE CROSSONER OUTSIDE AIR TEMPERATURE FOR HEATING IS

ABOUT 50°F. THE # HDD/YR BASED ON A 50° CROSSOVER

TEMP. IS CALCULATED A BOVE FROM THE ARMY TM 5-785

ENGINEERING NERTHER DATA FOR FORT BLISS, TX.

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JOB	
SHEET NO.	5 of 5
CALCULATED BY	7/3/01
CHECKED BY	. DATE
SCALE	

MONTHLY COOLING WAS CALCULATION. (TON-HRS) FROM TRACE GOD BUBG. MODELS.

ANNUAL TECH MUEA COOLING LUAD = 1,251,743 TON-HIS

A MULAL BASELINE CHILLED WATER FOLIPMY
ELECTRICAL CONSUMPTION = 1,411,650 KWH

ALLOCATE THE ANNUAL TON-HE LOAD TO MONTHS USING, MONTHLY
FRACTION OF CHILLED WATER EQUIPMENT ANNUAL KW-MO. (FROM TRAVE)

JAN FEB MAR APR MAY JUN THE MUB SET OUT NOW. DEC B-D6. 1506 18,9 53,4 87,7 92,6 95,5 ,93,0 86,2 54,9 7,2 31.6 38.6 57.4 62.8 66.2 70.9 70.1 65.1 82.9 37.3 93.5 1512 1526 206 40.5 62.6 79.2 81.8 142.3 137.3 77.4 61.1 36.3 20.3 20.1 1528 23,2 26,4 29,2 36,3 39,2 41.3 45,3 44,2 40,7 36,2 28,1 24,6 1530 19.5 78.9 150.5 157.18 146.2 73.6 63.8 0 1621 0 18.9 31.4 42.9 54.0 55.0 54.4 40.8 30.2 19.3 1622/23 19,1 19,2 19,4 21,2 83,4 138,7 142,2 135,1 81,1 56,9 19,4 19,1 1624 31.7 52.0 64.9 72.9 81.3 8517 83.7 75.2 66.2 50.8 38.0

TOTAL 43,4 130,0 217,5 347,2 547 706,4 788,2 764 540,1 452,2 148,4 195,5

Km-mo = 4980,4 # TON-HUS = 1,251,743 FON-HU = 251,3 TONHO

MONTHLY TON-HES COOLING LOAD = 75/3 TON-HE # KW-MO.

1000 TON-HE. 23.6 327 5417 87.3 137.5 177.5 198.1 192,0 135.7 113.6 49.9 49.1

MBTU 283 3.94 656 1,048 1,650 2,300 2,377 2,304 1,628 1,363 599 589

Ly Use as chw load on CUBEN ALT #3 + ACT#4

JOB WEW!	2 ESOS STUDY	#1110-000
SHEET NO.	,	/ of 6
CALCULATED BY _	TF	DATE 11-04-92

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TECH AREA CONSULIDATED CHILED WATER DLANG

	DAILY	COOLING	LUND PI	iofiles	
Sou	RCE! TR	ACE CONSOLI	DATED LO	AD RUN	(mBtu/hr)
HR.	WAT	APL	JUL	oct	
1	. 0	0-283	2,523	0.291	
2 3	· ~ · •	0.251	2,219	0,243	
3	0.039	0.221	1.883	0.215	
4	0.063	0-215	1.639	0.213	
. 5	0.063	0-214	1,490	0.212	
6	0.063	0.217	1,381.	0.210	
	0.197	0.313	1,792	5.289	
7	0.225	0.385	2,403	0,334	
9	0.256	0.762	3,824	0,505	
10	0.309	1.113	4,756	1,034	

. 5	0.063	0-214	1,490	0.212
6	0.063	0.217	1,381.	0.210
7	0.197	0.313	1,792	0.289
8	0.225	0.385	2,403	0,334
9	0.256	0.762	3,824	0,505
10	0.309	1.113	4,756	1,034
11	0-352	1.326	5.612	1,241
17 13 12 12 12 12 12 12 12 12 12 12 12 12 12	0-385	2.061	6.211	1,529
3 13	0.392	2,748	6.493	2.925
170 14	0.427	3.027	6.716	3.326
2 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/	0.442	3,218	6,824	3,622
12 16	0.460	3.345	6.927	3.977
MAND G	0.62-3	2.951	6. 464	3.454
30 18	0.528	2.934	6,002	3,121
19	0.433	2.623	5.685	2.803
20	0.263	1.756	4.775	1,754
21	0,212	1,395	4.284	1,210
22	0.206	1.051	3,822	0.871
. 23	0.203	0.789	3,301	0,632
24	0.200	0.625	2.905	0.515
NERMAE	0.264	1.111	4.164	1.439
ON PEAK	A 1/3 /	2.599	6.171	2.775

ON PEAK 0.43/ 2.599 6.171 2.775

JOB WSMR ESOS	STUDY # 1110-000
SHEET NO.	2 of _
CALCULATED BY TF	DATE 11-04-92
CHECKED BY	DATE

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TECH AREA CONSULIDATED COOLING LOAD

D JULY A OCT APM MAT X 500 400-HOURLY COOLING LOAD (TUNS) 300. 200 100 00

SCALE

TIME OF DAY

SOURCE: TRACE CONSOLIDATED COOLING LOAD COMPUTER RUN

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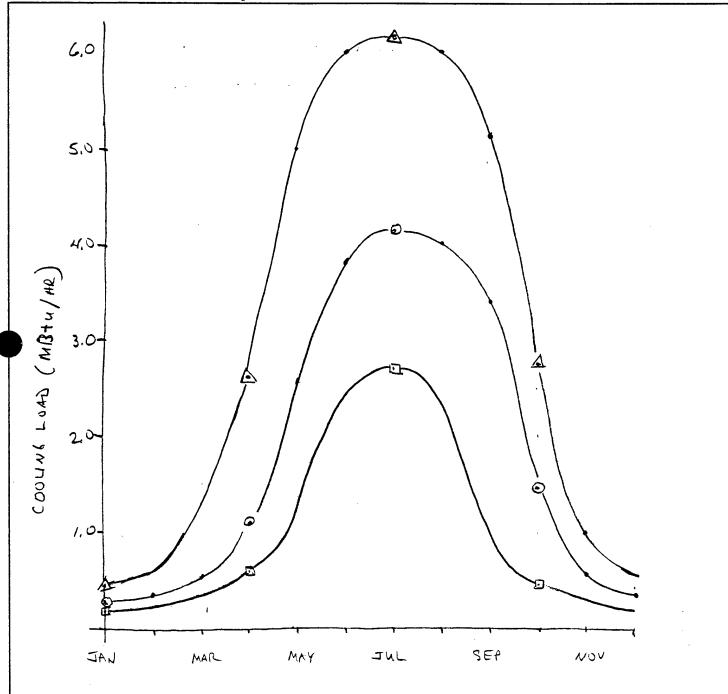
TECH AREA CONSULIDATED COULING LOAD (AVERAGES)

@ DAILY AVERAGE

ON PEAKLANERAGE

OFF PEAK AVERAGE

JOB WSMR	ESOS STUDY	#1110-000
SHEET NO.		30F 6
CALCULATED BY	TF	DATE 11-04-92
CHECKED BY		DATE
SCALE		



JOB WSMIR ESOS STUDY	#1/10-000
SHEET NO.	4 of 6
CALCULATED BYT	DATE 11-04-92

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TECH AREA SPACE HEAT LOAD + SCALE.

_ HR_	MAT	FEB	MAR	APR	SEP	u/dn) OCT	NOV	DEC
1	4.519	3,233		0	0	0,028	0.116	0.252
2	5.073		1.121	0,012		0.047	0,197	
3	5.563	4.101				0.065		
4	6.022	4,541				0,097		
5	6.377	4.732	2066	0.071		0.108	0-55	2,770
6	6.524	5,555	2,228	0,101		0.124	0.914	3,463
	6.721	4.948				6	1,089	
8	4,880	4,361	1.625	0.183			1,600	3,146
9	2801	Z, 250	0,079	0		1	0.418	1,726
,0	1.775	1,237	0	i	1	1	0	0.760
11	0.739	0,410						0.091
12	0.272	0.049		į			ĺ	0.015
/ 13	0.041	0						ې
14	0		-					
13 14 15 16								
16								
						}		
18								
19		1	}					
20	0.055			1			}	
•	0.254	1						0.014
21	0.565	0.112	+					0.116
	1.688		0.022	- 1	l			0,498
21/	2.965	0,900	0,085	\downarrow	Ţ		_	1,241
	2.114				· · · · · · · · · · · · · · · · · · ·	•		
DAILY AVE	2.40 1	740 D	.563 C	,028	0	0.020	0,222	0.963
(MBtu/hr)	- (
ON PEAK	0.111 0	.046	٥	0	0	0	0	0,010
MBtu/hr)	·							

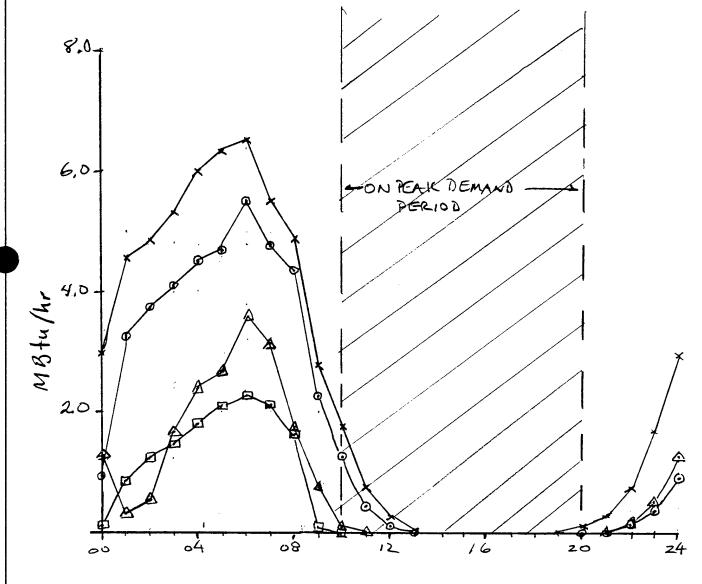
AREA THAT IS HEATED IN THE 27 BLDGS IN THE TECH AREA.

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TECH AREA HEATING LOAD.

JOB		
SHEET NO.	5 of 6	
CALCULATED BY	DATE	
CHECKED BY	DATE	
SCALE		

HOURLY SPACE HEATING LUAD FOR 27 BLOGS.



X JAN

@ FEB

A DEC

1 MAL

JOB_WSMR E	sos study	世1110-000
SHEET NO.	6	of <u>6</u>
CALCULATED BY	TF	DATE 11-05-92
CHECKED BY	•	DATE
SCALE		

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TECHAREA STEAM LOADS.

ALT#3 5/ALT#4

SPACEHEATING & PROCESS LUADS

NOTE: FROM ECUTIO ANALYSIS, PROCESS LOAD FOR
THE TECH AREA IS 0,500 MBty/HR FROM 0800 to 1700
DAILY.

DAILY AVE, STEAM LOAD = (MONTHLY DAILY AVE, X24 + 8X0,5)106
24 × 869.6 BTU/LB

UN PERK AUR STEAM LUAD = (ON PEAK AUE X 10 + 6 X 05)10 1 (LB/HM) 10 X 869.6

Y

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION: Whit	te Sands Missil	e Range	REGION:	4		PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	TECH AREA	CHILLER PLANT (ALT 1)				FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL					
		ANALYSIS DATE:	07/13/92		ECONOMIC LIFE:	25		PREPARED BY:	A. NIEMEYER
1	INV	/ESTMENT							•
	A.	CONSTRUCTION	COST	-				\$1,680,663	
	В.	SIOH COST		(5.5% of 1A) =				\$ 92,438	
	C.	DESIGN COST		(6.0% of 1A) =				\$100,840	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =				\$1,873,939	
	E.	SALVAGE VALUE		=				\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =				>	\$1,873,939
2	EN	ERGY SAVINGS (+)	/COST (-)						
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL	DIS	COUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3) FAC	CTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	7,654	\$49,55	7	15.23	\$754,749	
	В.	DIST		0	\$4)	17.28	\$0	
		NAT GAS	\$2.21	0	\$)	19.64	\$0	
	D.	PAPER		0	\$)		\$0	
		COAL			\$4)	16.22	\$0	
	F.	TOTAL		7,654	49,556.	7		· >	\$ 754,749
•	NO	N EVEDOV ON AN	004240007	, ,					
3		N-ENERGY SAVIN		• •				***	
	^.	MAINTENANCE CO		C. DEMAND SAVINGS +	•	•		\$98,285	
		1 DISCOUNT FAC			/Erom Toble A 0)	_	14.00		
		2 DISCOUNTED S		-OST (_)	(From Table A-2) =		14.68	* 4 440 040	i
	R	NON-RECURRING		OSI (-)	(3A x 3A1) =	•		\$1,442,816	4
	-	ITEM	∠ (+1−)		YEAR O	E DIS	COUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2		CTOR (3)	DISCOUNTED SAVINGS (4)	
		a. EQUIP REPLAC	EMENT COST		•	, FAC	0.96		
		b. EQUIP REPLACE		••		' 5	0.80	\$96,000 \$154,800	
		c. EQUIP REPLAC			10		0.64	\$154,800 \$456,480	
		d TOTAL		\$1,006,750		•	0.04	\$707,280	
	C.		RGY DISCOUN	ITED SAVINGS (+) / COS	ST (-)	(3∆2 ±	3Bd4) =	\$707,280	\$2,150,096
		PROJECT NON-E			- 🕶	(O) 42 T	Jan 1, 1		WE, 100,000
		1 25% MAXIMUM		CALCULATION		(2F5)	x 0.33) =	\$249,067	
		a IF 3D1 => 3C 1				(5. 4.		4270,007	
		b IF 3D1 < 3C Th				(2F5 + 3D	1) / 1F =	0.54	
		c IF 3D1b => 1 T				,	., =	0.54	
		d IF 3D1b < 1 TH	IEN PROJECT	DOES NOT QUALIFY	 .				
					THIS ECO F	AILS TH	E E	CIP PROJECT	NOW-ENERGYTES
4	FIR	RST YEAR DOLLAR	SAVINGS (+) /	COSTS (-)	(2F	3 + 3A + (3B1	(d/25)) =		\$188,111
		TAL NET DISCOUN			•	,	; 5 + 3C) =		\$2,904,846
6	DIS	SCOUNTED SAVING	S-TO-INVES	TMENT RATIO (SIR)		,-	(5/1F) =		1.55
		FOID 44 THEN DO		` '			,		

(1F/4) =

9.96

(IF SIR < 1 THEN PROJECT DOES NOT QUALIFY)

7 SIMPLE PAYBACK (SPB)

JOB WSMR LESO	YEUTZ Z	#1110-000
SHEET NO.	OF	
CALCULATED BY	DATE	7/12/92
CHECKED BY	DATE	

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ALT#1	ENGRGY	SAUINGS	SUMMARY
		,	C. Carolica I

	(Lw 4)	(ZKW)	ELECTA SAVINA (ILWH)	er (ICM)	ANN. MAINT SAVINGS (4/m)
BASEUNE	6,682,725	19,679			
A-LT #1	4,440,255	13,602	2,242,470	6,077	-20,217

+ FROM TRACE 600 RMAS

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKD	NMO							
CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SOL	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENYER, CO 80227	ORTH BLV	D., #C-200.	DENVER. C	O 80227	
CONTRACT	CONTRACT FOR (Work to be performed) TECH AREA (ALT 1)						PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	IDS MISSIFE	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	L COST		LABOR COSTS			
Line	Item	o Gi	Quantity			Manhours	Average	:	Other	eui
Š.	(Ξ)	Measure (2)	6	S Gif	Total	Mandays	Rate	Total	Costs	Total
-	175 TON CENTRIF. CHILLER & TOWER 375 TON CENTRIF. CHILLER & TOWER	LUMP	-	275000	275000	6	8	2	(6)	\$275.000.00
8	PUMPS, VALVES, ETC.	LUMP SUM	1	160600	160600					\$160,600.00
က	1600 SQ.FT. BLDG.	SF	1600	30.00	48000					\$48,000.00
4	BURIED CWS & CWR PIPING	LUMP SUM	1	558700	558700					\$558,700.00
S.	VAULT W/EXP. JOINTS, VALVES, ENCHORS, ETC	Ę	S.	10800	54000					\$54,000.00
9	INTERCONNECTION @ BLDG.	Ē	6	14000	126000					\$126,000.00
	SUBTOTAL									\$1,222,300.00
	OVERHEAD & PROFIT (25%)									\$305,575.00
	CONTINGENCY (10%)									\$152,787.50
	TOTAL THIS SHEET									\$1,680,662.50
							:			~

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TECH AREA

ALT. 1

and in the season

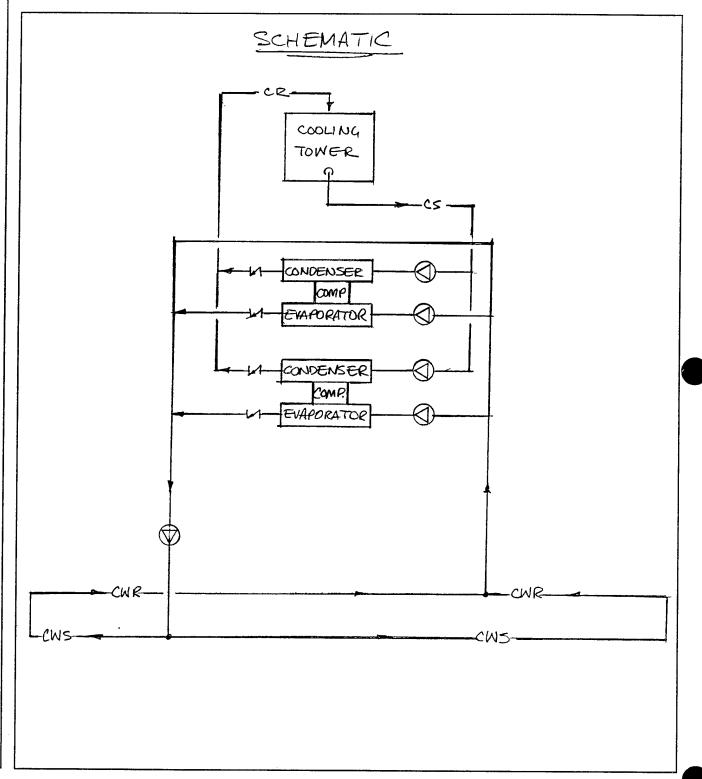
JOB WSMR #505 STUDY # 1110.000

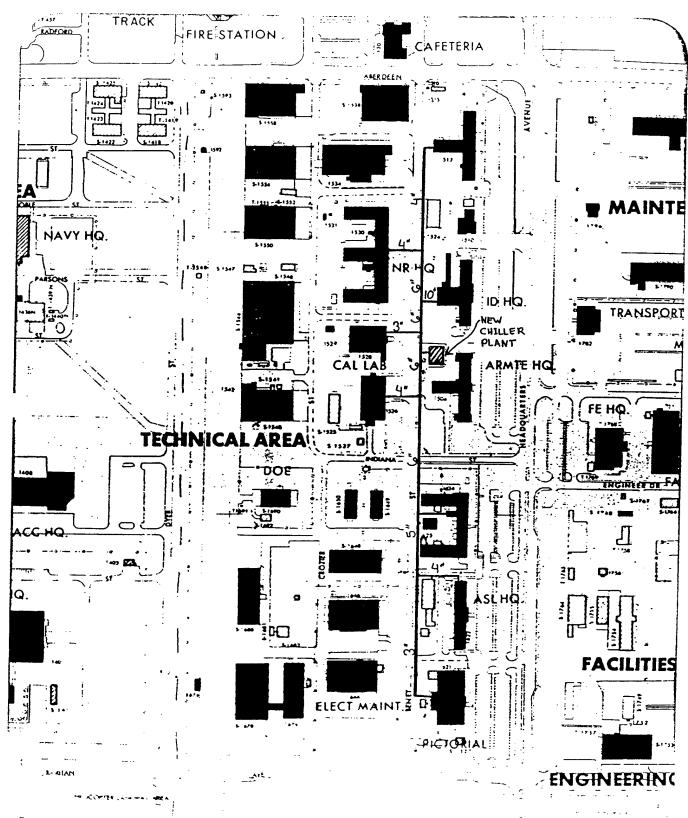
SHEET NO. ______ OF _____

CALCULATED BY C. Buffer DATE 3.17.97

CHECKED BY _____ DATE ______

SCALE _____





CHELLEDWATER DISTRIBUTION PIPING

JOB WISMR ESDS STUDY	# 1110.000
SHEET NO.	_ OF
CALCULATED BY C. Butley	DATE 3,17-92
CHECKED BY A	DATE 3.20.92

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TECH AREA

ALT. 1,

```
PROJECTED COST OF COMPLETE SYSTEM: (INSTALLED)
  *1-275 T CENTRIF, CHILLER & TOWER? $50 / 2500/T. = 275,000
  *1-175T "
   2-420 GPM CENTRIF PUMP, VALVES; ETC. x 20.2$/GPM = 17,000
   2-660 GPM
                                                    27,000
 *{2·525GPM
                                                    21,200
   2-825 GPM "
                                                   33,300
  2-1536 GPM "
                                                    62,100
  * BLDG. 1600 Sqf+ @$30/Sqf+
                                                    48,000
   BURIED CWS & CWR APING (INSULATED CONDUIT W/CATH. PROTN)
    104 501 @$275/LF
                                                    13,800
 * 8" 1440' @ $ 230/LF
                                                   331,200
    6" 650' @9190/LF
                                                   123,500
    5" 3361 @5165/LF
                                                    55,400
   4" 2401 @$145/LF
                                                    34,800
$ 5- VAULT W/ EXP. JOINTS, VALVES, ANCHORS, ETG. @ 10,800 FA
                                                   54,000
 9- INTERCONNECTION @ BLDC. @ 14000 FA
                                                   126,000
```

1,172,300

^{1.} COSTS ARE COMPOSITE FIGURES USING EXTRAPOLATED
EQUIPMENT QUOTES & INSTALLATION DATA FROM BUTH
MEANS ESTIMATING GUIDE AND RICHARDSON ESTIMATING
GUIDE,

^{2.} ABOVE COSTS CONTAIN MATERIAL, LABOR & EQUIPMENT VALUES BUT DO NOT CONTAIN OVERHEAD OR PROFIT

HANUFACTURER	DUN	IHAM-BUSI	4		TDANK	_				
CHILLER		GE SCRE		1 971	TRANE GE SCREY				RANE	
CHILLER DRIVE		ELECTRIC					3 STAGE	CENTRIF	UGAL	
MAX. OUTPUT TONS		500			ELECTRIC			ELECT	TRIC	
MAX. OUTPUT HBH		6,000			300				500	
MAX. INPUT KW (KW/TON)		-) (.66)		3,500			5 ,	,000	•
MAX. RECOVERABLE HEAT MB	H jim					(-77)			358(.	716)
T OF MAX TO START	'است	10			0			•	0	
ELEC. ACCESS. KW (KW/TON)		(.12)		10				10	
* ACCESS. TO VARY WITH L		40	-			(.12).			60(.	12)
CONDENSER WATER RANGE F		60 - 80			. 40	-			40	
AVAILABLE SIZES TONS	1:	30 ~ 900			60 - 80		:	60 -		
CORRISPONDING FULL LOAD					00 - 300		•	100 - 1	6 30	
INPUT_KW/TON					.8 – .75	-	•	.8,7 -	. 68	
	×	x .	x	-	_					•
	LOAD	• •		. LOAI	X **********	X		`	X	*
I MOH = 103 BTUH	. 10	11	O				; · -		HPUT	RECV.
	20	13	0	10		D			12	. 0
	30	18	0	20	19	0.	•		17	, 0
	40	24	0	30	•	0			23	0
	50	36	Ö	- 40	- 1 T	0			32	0
	60		0	50	37	. 0		· . ·	11	0 , :
	70	55	. 0	60 70	46	. 0			50-	0
	80	70	. 0	70	57	0	٠.	_	9	0
	90	82	0	80 90	69	0			0	. 0
	100	100	0	100	83	0		`	13	0
		17.	:	100	100	· . 0	. 10	90 g	5 .	٥.
	. *	•								•
MANUFACTURER		YORK			TRANE	*	•	0		
CHILLER 1 STAG	E CENTI	RIFUGAL		SE ARS	ORPTION			CARRI		
CHILLER DRIVE	. EI	LECTRIC	• .	240 F HO		٠,٠	SE A	BSORPTI		•
MAX. OUTPUT TOHS		500			500		٠.	STE		
, МАХ. OUTPUT МВН ^{1≮음년}		6,000		•	6,000				00.	
MAX. INPUT MBH OR KW(INPUT	(NOT\	350(.7)		8,750(17.5)	•	5,0	•	
MAX. RECOVERABLE HEAT MBH				•	0	40,		3,0	52(18.	. 12)
% OF MAX TO START		10		•	10				0 10 .	
ELEC. ACCESS. KW (KW/TON)	•	60(12)		80(.	.151				• •
* ACCESS. TO VARY WITH LOA	ND OI	. 40			40	,			80(, 18 10	·)
CONDENSER WATER RANGE F	8	0 - 80	·	6	08 - 0				35	
AVAILABLE SIZES TONS	150	- 1000			- 1660			•	,,	
CORRESPONDING FULL LOAD	.74	73			- 17.1					
INPUT PER TON										
•		.•					-			
	x	x	×	x	x	× x	x	x		x
	LOAD	INPUT	RECV.	LOAD	INPUT	RECV.	LOA			RECV.
·	10	18	. 0	10	12	0	10			0
	20	22	0	20	16	0	20	•		0
	30	27	0	30	23	0	30			0
* .	40	33	0	40	31	0	40			0
.* •	50	40	0	50	40	0	50			0
·	60	47	0	60	49	0	60			0
	70	56	0	70	60	0	70			0
	80	67	0	80	70	0	80			0
	90	78	0	90	82	0	90	_	-	0
	100	91	0	100	94	0	100	100		0
				_						_

NOTE. ALL VAPOR COMPRESSION CHILLERS HAVE 10x FOULING PENALTY INCLUDED IN INPUT DATA FULL LOAD INPUTS ARE FOR MEDIUM EFFECTENCY OF ALL CUTTURES.

D21-7

CHILLER DRIVE MAX. OUTPUT TONS MAX. OUTPUT MBH MAX. INPUT MBH OR KW(INPUT/TON) MAX. RECOVERABLE HEAT MBH X OF MAX TO START ELEC. ACCESS. KW (KW/TON) X ACCESS. TO VARY WITH LOAD CONDENSER WATER RANGE F AVAILABLE SIZE TONS 385	0 10 80(.15) 40 60 - 80 - 1000	HITACHI DE ABSORPTION SCREW INC DIRECT FIRED* 500 6,000 (LHV) 5,868(11.74) 0 30 70(.14) 40 65 - 80 100 - 1500	TECOCHILL L. ECONOMIZER GAS ENGINE 150 1,800 (LHV) 1,245(8.3) 659 10 20(.13) 40 60 - 80
COPPIEDOUNTUO EUR LIGAR	- 1000 - 11.9		50 - 80

3	K X	x	x	x	¥	•		
LOA	NPUT	RECV.	LOAD	INPUT	RECV.	1040	7	X.
10	9	0	10			LOAD	INPUT	RECV
20	15	0.		16 .	0	10	9	10
			20	22	. 0	20	17	18
30		. 0	30	28	0	30	23	24
40	30	0	40	34	ο.	40		
50	38	0	. 50	43	0		31	32
- 60	46	0			. •	, 50	40	. 42
70		٠.	60	51	0.	60	48	50
	• • • • • • • • • • • • • • • • • • • •	0	70	62	0	70	60	62
80	67	0	80	71	0	80	- 71	•
90	_. 78	0	90	83	٥			72
100	94	0	100		•	90	87	87
		-	. 100	95	0.	100	100	100

* INPUT AS ENGINE CHILLER IN PC-CUBE

BOILERS AND HEATERS

GENERIC ATMOSPHERIC 30,128 37,661 0	GENERIC POMER 7,532 9,415 3.7	PK THERMIFIC POWER 1,292 1,520	HITACHI POWER 6,000 7,434 3.0
x	x	x	x
INPUT	TNOUT		
19.0			INPUT
			25.0
		23.0	32.0
		32.0	40.0
	42.6	41.0	49.0
	51.9	50.5	56.0
63.0	50.0	60.50	64.0
72.0	70.0	70.0	72.0
81.0	80.0	*	
90.0			81.0
100.0			90.0
	ATMOSPHERIC 30,128 37,661 0 ED) X INPUT 19.0 29.0 37.0 45.0 54.0 63.0 72.0 81.0 90.0	ATMOSPHERIC 30,128 7,532 37,661 9,415 0 3.7 ED) X X X INPUT INPUT 19.0 17.7 29.0 26.2 37.0 34.7 45.0 42.8 54.0 51.9 63.0 60.0 72.0 70.0 81.0 80.0 90.0 90.0	ATMOSPHERIC POMER POWER 30,128 7,532 1,292 37,661 9,415 1,520 0 3.7 0.75 INPUT INPUT INPUT INPUT 19.0 17.7 14.0 29.0 26.2 23.0 37.0 34.7 32.0 45.0 42.6 41.0 54.0 51.9 50.5 63.0 60.0 60.50 72.0 70.0 70.0 81.0 80.0 90.0 90.0

TECH AREA: ALT #1

Trane Air Conditioning Economics By: Trane Customer Direct Service Network

NO STORAGE

cw pump 39.3 KW COND. PUMP - 25.5 KW

V 60 PAGE

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

CHILLER -

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	WATER (1000 GL)			
Jan Feb March April May June July Aug Sept Oct Nov Dec	313,076 283,973 336,592 330,126 408,007 448,891 470,093 481,842 397,007 357,012 305,983 307,652 4,440,255	926 942 1,018 1,115 1,256 1,322 1,346 1,329 1,257 1,145 1,000 946 1,346	66 64 116 209 500 721 846 804 515 237 101 75	2 monthly k	LW= 13,	,602

Building Energy Consumption = Source Energy Consumption =

49,903 (Btu/Sq Ft/Year) 149,723 (Btu/Sq Ft/Year)

Floor Area =

303,682 (Sq Ft)

123 0 0 3 7 0 2 2

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

indication (

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

TECH AREA

V 600 PAGE

EQUIPMENT	ENERGY	CONSUMPTION-
-----------	--------	--------------

Nun	Code						Monthly	Consumpt	ion		~****			
		J.	n Fel	Mar C	` Ap		ay Ju				Sep (ct No		
0	LIGHTS									•	r v	C. MC	ov Dec	Tota
	ELEC	12068	8 109396	131064	1157/									
	PK	495.	7 495.7				6 12557	71 1160	73 1310	64 115	768 1258	76 11462	3 116073	1 //7 6/
			,,,,,,	493.1	495.	7 495.	7 495.	.7 495	.7 495	.7 495	.7 495	_		1,447,84
1	MISC LD											·		495.7
	ELEC	12610	0 114063	130921	121513	12004	4 45444							
	PK	332.			332.5		1 12610					1 12105	123918	1,497,052
				002.3	232,3	332.5	332.	5 332.	.5 332.	.5 332	.5 332.			332,5
2	MISC LD													332,3
	GAS	(0	٥		_								
	PK	0.0	_	0.0	0.0	•				0	0	0 0		
			-11	V .U	0.0	0.0	0.0	0.	0 o.	0 0.	.0 0.1		_	0
3	MISC LD												•••	0.0
	OIL	0	0	٥	0		_							
	PK	0.0	0.0	0.0	0.0	0 0.0	_				0 () o	Û	0
					0.0	0.0	0.0	0.0	0.	0 0.	0 0.0	0.0	0.0	0.0
	MISC LD													9.0
	P STEAM	0	0	0	0	o	0			_				
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	_		O O		0	
						V.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	HISC LD												,	
	HOTH20	0	0	0	0	0	0	0						
•	K	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	•	_	0	0	0
	ISC LD						7.0	v .u	0.0	0.0	0.0	0.0	0.0	0.0
	CHILL K	0	0	0	0	0	0	0	^		_			
•		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0,0	-	0	0	0
=	21001s							***	0.0	0.0	0.0	0.0	0.0	0.0
	.EC	4700/		CTV <55	5 TONS									
P		17254 37.0			30945	41107	50723	58891	59953	44908	30542	2474		
•	•	37.0	46.0	110.8	111.0	112.8	121.7	129.3	124.1	125.4	114.7	21745		414,620 🗸
ΕC	5100									123,4	(14.7	93.6	46.2 🛫	129.3
	EC	78		NG TOWER									2=	1173
PK		4.1	194	1604	4561	8000	10208	10548	10548	10208	6591	1100		
		4.1	6.8	13.1	14.2	14.2	14.2	14.2	14.2	14.2	14.2	1182 12_3	301	64,025
ΕQ	5100		COD! 11								17.2	12.3	8.9 - 17	12.6 14.2
	TER	66	64	IG TOWER										
PK		0.2	0.3	116	167	237	296	328	335	252	164	101	75	
		•••	0.3	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.6	0.6	75 0,3	2,201
EQ:	001		CHILLE	D WATER	Billun e :								513	0.7
ELI	C	29239					***							
PK		39.3	_		_			29239	29239	28296	29239	28296	29239	7/1 412 4
					J7.3	39.3	39.3	39.3	39.3	39.3	39.3			344,268
EQS	010		CONDEN	SER WATER	Directs =								254	171,6 39.3
LE	C	18972												
K		25,5			_				18972	18360	18972	18360 1	8972	227 700
		-			.J.3	25,5	25.5	25.5	25.5	25.5	25.5		25.5 Z=3	223,380

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1

				ACTERNATI										
	1 EQ 5300	cov	JTRAL PI	anel 4:	LNYER L	σκ,							· i	
	ELEC PK	744 1.0	672 1.0	744 1-0	720 1.0	744 1.0	720 1.0	744 1.0	744 1.0	720 1.0	744 1.0	720		8,760 [/]
	2 Eq1001S		2-5	TG CTV <	SEE TOUG						1.0	1.0	1.0 ≥=	4 0 1
,	ELEC PK 2 EQ5100	0.0	0.0	0.0	7453 119.5	44638 215.8	73656 260.7	93946 277.0	84836 265.9	46721 216.7	12552 140.0	0 0.0	a	363,802 / 196 277.0 14
			COO	LING TOWE	R								2-1	176
_	ELEC PK	0.0	0.0	0.0	2431 30.4	10573 30.4	14765 30.4	17196 30.4	15069 30.4	10178 30.4	3858 30.4	0.0	0	74,070 13 30.4 212
2	EQ5100		COOL	ING TOWE	b								-11 200	15 30.4 210
	WATER PK	0.0	0.0	0.0	43 0.7	263 1.3	425 1.4	517	469	264	73	0	0	2,053
_							1 4	1.5	1.4	1.2	0.9	0.0	0.0	1.5
2	EQ5001		CHIL	LED WATER	PIMP C	v							•••	1.3
	ETEC	0	0	0	0									
	PK	0.0	0.0	0.0	0.0	0 0.0	0.0	0.0	0.0	0 0.0	0 0.a	0,0	0 0.0	0
2	E95010		CONDE	NSER WAT	£0 NWA							-14	0.0	0.0
	ELEC	٥	0	0										
	PK	0.0	0.0	0.0	0 0.0	0.0	0.0	0.0	0 0.0	0.0	0 0.0	0.0	a 0.0	0
2	£95300		CONTR	Of DAVE								0.0	0.0	0.0
	ELEC	0	0	OL PANEL										
	PK	1.0	0.0	0.0	80 1.0	348 1-0	486 1.0	566 1.0.	496 1.0	335 1.0	127 1.0	0 0.0	0.0 S= 7	2,438 × 1.0 12
9	E04000		50 th :	1 _	-		-			1.0	1.0	0.0	0.0 5= 7	1.0 12
	ELEC		PREVE	ITS FAN E	NERGY								<u> </u>	
	PK	0	0	0	0	٥	0	0	0	•				
	' N	0.0	0,0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0 0.0	0 0.0

5 1cw/month = 3831

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TECHNICAL AREA CHILLED WATER LOOP

JOB WSMR	ESDS ST	UDY # 11	10-000
SHEET NO.	1	OF	Z
CALCULATED BY	. Bulley	DATE	5.92
CHECKED BY		DATE	
SCALE			

		3/2 2001			
	PM 1	SO ENGTIFY H		40 LOSS	ACCUM.
i u	696	70	3.10	2.17	
i '	576		2.15	5.59	
	384		1.00	3.20	>
		780	1.21	9.47	
		•	,, =	2099	-)
		·			
1011	536	50	1.12	0.56	
	84Q	370	4.45	16.47	
1	600	820	2,33	19.11	
51	336	440	1.94	8.54	
3"	96	1000	2,20	22.00	
				66.67	
10" 1	536	50	1.12	0.56	
į	840	370	1-11	4.11)
		820	0.59	4.84	
5"		440	1,94	8.54	
4"	96	1000	0,58	5.80	
				23.85	J
LARGUST	PIPING	LUSS =	23.85	SAY	24.0
		+ 10701	FITTINGS		2-4
		+ ASSUME	LOSSOI	3L04.	40.0
		+ COHILE	FR & PIPINO	: HD	20,0
				•	86,41
			+ 10% 001	ITIN	3.6
* . 			= 2 PIVING + 10% COI -URN,		35.0'
*LENGTH IS F	BUTH SUP	PLY + RET	TURN,		

न्यक्षिक्ष

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TECHNICAL AREA.
CHILLED WATER LOOP.

JOB WSMR ESUS STUD	U # 1110 -000
SHEET NO	_ OF
CALCULATED BY C- Butier	_ DATE 3 · 6 · 92
CHECKED BY	DATE
SCALE	

PUMPING H.P.

$$= \frac{1536 \times 95 \times 1.044}{3960 \times 0.7}$$

MOTOR HP:

* 1.2 ALLOWS FOR BELT FRICTION LOSSES,

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION: White	e Sands Missil	e Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152	
		PROJECT TITLE:	TECH AREA	CHILLER PLANT (ALT 2)			FISCAL YEAR:	1992	
		DISCRETE PORTIC	ON NAME:	TOTAL					
		ANALYSIS DATE:	07/13/92		ECONOMIC LIFE:	25	PREPARED BY:	A. NIEMEYER	
1	INV	ESTMENT							
	A.	CONSTRUCTION	COST				\$2,378,200		
	В.	SIOH COST		(5.5% of 1A) =			\$130,801		
	C.	DESIGN COST		(6.0% of 1A) =			\$142,692		
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$2,651,693		
	E.	SALVAGE VALUE		=			\$0		
	F.	TOTAL INVESTME	NT	(1D - 1E) =			 >	\$2,651,693	
2	ENI	ERGY SAVINGS (+)	/ COST ()						
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED		
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	•	
	A.	ELEC	\$6.48	7,410	\$47,979	15.23	\$730,720		
	В.	DIST		0	\$0	17.28	\$0		
	C.	NAT GAS	\$2.21	0	\$0	19.64	\$0		
	D.	PAPER		0	\$0		\$0		
	E.	COAL			\$0	16.22	\$0		
	F.	TOTAL		7,410	47,979.0		 >	\$730,720	
3	NO.	N-ENERGY SAVING	GS (+) / COST	(-)					
	A.	ANNUAL RECURRI	ING (+/-) (ELE	C. DEMAND SAVINGS +	2		\$123,223		
		MAINTENANCE CO	OST SAVINGS)	1					
		1 DISCOUNT FACT	TOR		(From Table A-2) =	14.68			
		2 DISCOUNTED S	AVINGS (+) / C	OST (-)	(3A x 3A1) =		\$1,808,906		
	В.	NON-RECURRING	i (+/ -)						
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED		
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)		
		a. EQUIP REPLAC		••	1	0.96	\$257,242		
		b. EQUIP REPLAC			5	0.80	\$154,800		
		c. EQUIP REPLACE	EMENT COST	, ,	10	0.64	\$456,480		
	_	d TOTAL		\$1,174,710			\$868,522		
				ITED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$2,677,428	
	D.	PROJECT NON-EN							
		1 25% MAXIMUM I				(2F5 x 0.33) =	\$241,138		
		a IF 3D1 => 3C T							
		b IF 3D1 < 3C TH		TE SIR		(2F5 + 3D1) / 1F =	0.37		
		c IF 3D1b => 1 Ti		DOTE 1/2					
		a IF3D1b<1TH	EN PROJECT	DOES NOT QUALIFY	THIS ECO FAI	LS THE ECI	P PROTECT A	JON-ENERGY TES	7
	EID	ST VEAD DOLLAR	CAMINICO						. 1
		ST YEAR DOLLAR S			(2F3	+ 3A + (3B1d/25)) =		\$218,190	
		TAL NET DISCOUNT				(2F5 + 3C) =	•	\$3,408,148	
0		COUNTED SAVING		• •		(5/1F) =		1.29	
	(11-	SIR < 1 THEN PRO	MEG! DOES!	IOT QUALIFY)					

(1F/4) =

12.15

7 SIMPLE PAYBACK (SPB)

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JOB WSAL ESUS S	STYDY #1110-000
SHEET NO.	OF
CALCULATED BY TF	DATE 7/15/92
CHECKED BY	DATE
SCALE	

ALT# 2 ENERGY SAVINGS SUMMARY

i.		ELECTAL O SAVIN	65	MAINT. SAVINGS
	(1cmH) (1cm)	(KWH)	(1cm)	#/4
	6,682,725 19,679			1
A-1T#2	4511,648 # 11,250 4	2,171,077	8,429	(41, 143)

THE THERMAL STORAGE SHIFTS ALL CHW SYST, EQUIPMENT LOADS TO NIGHT EXCEPT FOR THE BLOK & PLANT CHW PUMPS;

THE LITILITY REBATE SHOWLD BE THE MONTHLY AVE. REDUCTION IN DEMAND X 190 :

8,429 kw x \$90 = \$1,33,459 UTILITY REGARE.

		CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKD	NMC							
NOS	CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SO	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	ORTH BLVI	D., #C-200,	DENVER, C	O 80227	
NOS NOS	TRACT FO	CONTRACT FOR (Work to be performed) TECH AREA (ALT 2)						PROPOSED TOTA	PROPOSED TOTAL CONTRACT PRICE		
PUR	CHASE RE	PURCHASE REQUEST NUMBER			PROJECT NUMBER	ABER		WORK LOCATION WHITE SAN	IDS MISSILE	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
					MATERIAL COST	AL COST		LABOR COSTS			
	Line	Item	o E	Quantity			Manhours	Average		Other	Line
	Ö	0	Measure (2)	6	Unit	Total	Mandays	Rate	Total	Costs	Total
	1	175 TON CENTRIF. CHILLER & TOWER 375 TON CENTRIF. CHILLER & TOWER	LUMP		275000	275000	E	3		(2)	\$275,000.00
	2	PUMPS, VALVES, ETC.	LUMP	1	160600	160600					\$160,600.00
	8	1600 SQ.FT. BLDG.	SF	1600	30.00	48000					\$48,000.00
	4	BURIED CWS & CWR PIPING	LUMP SUM	1	558700	558700					\$558,700.00
)22-3	Ω.	VAULT W/EXP. JOINTS, VALVES, ANCHORS, ETC	EA	5	10800	54000					\$54,000.00
	9	INTERCONNECTION @ BLDG.	EA	6	14000	126000					\$126,000.00
	7	THERMAL STOR. TANK & CONNECTING PIPES	LUMP SUM	-	450000	450000					\$450,000.00
	80	THREE-WAY CONTROL VALVE, 6"	LUMP SUM	1	3300	3300					\$3,300.00
	6	VARIABLE SPEED PUMP DRIVE (70 HP)	LUMP SUM	1	54000	54000					\$54,000.00
		SUBTOTAL									\$1,729,600.00
		OVERHEAD & PROFIT (25%)									\$432,400.00
		CONTINGENCY (10%)									\$216,200.00
	1	TOTAL THIS SHEET									\$2,378,200.00

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TECH AREA

ALT. Z

49644444

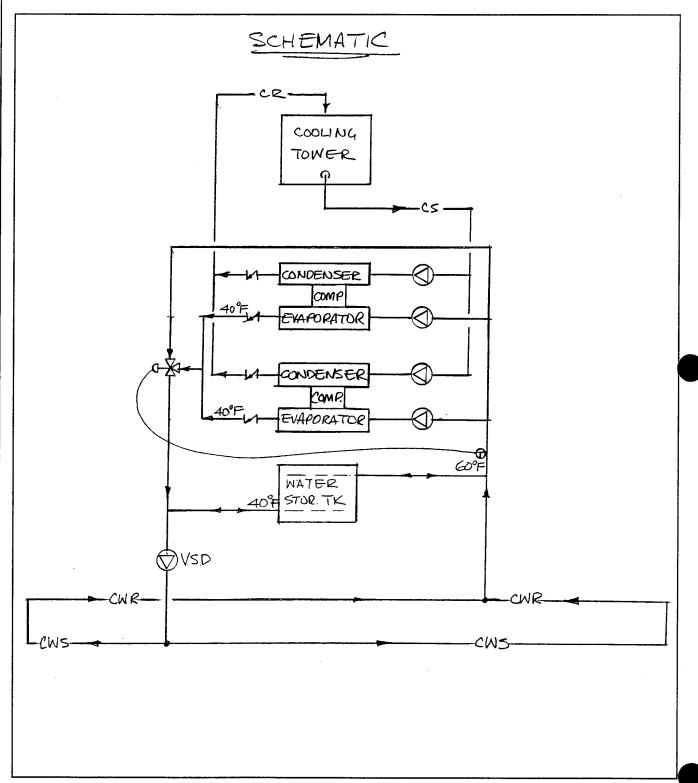
JOB LISMR FSOS STUDY # 1110.000

SHEET NO. ______ OF _____

CALCULATED BY _____ DATE _____ DATE _____

CHECKED BY _____ DATE _____

SCALE ______



	UTS SOS STU	DOO.0111 # YO
E M C ENGINEERS, INC.	SHEET NO.	OF
Denver • Colorado Springs • Atlanta • Germany	CALCULATED BY C. P. L. + L.	DATE 3.17.6?
TECH AREA	CHECKED BY	DATE
Λ	CONE	

ALT 2.	SCALE	
PROJECTED C	COST OF COMPLETE SYSTEM:	(INSTALLED)
COST. OF AL XI-THERMAL ST XI-THREE-WAY CO		1,172,300 450,000 3,300 54 ,000
		# 1,679,600

3334433343

Denver • Colorado Springs • Atlanta • Germany TECH AREA ALT. 2.

JOB WSUR ESOS STUDY	#1110.000
SHEET NO.	OF
CALCULATED BY C. P. Alex	DATE 3 .17-92
CHECKED BY	DATE 3.19.92
SCALE	

THERMAL STORAGE TANK SIZING

6000 TON HR TANK 81,000 @ 13.5 Cuft / TON HR. = 6000XB.5 = 414.4 Cuft.

OPTIMUM HT OF TANK = 12 ft.

FOOTPRINT AREA OF TANK = 444.4 /12 = 37. 59 ft.

 $A = \frac{\pi D^2}{4}$ OR $\frac{4A}{\pi} = D = \frac{4(37)}{3.19} = 6.87' SAY 7' <math>\phi$

TANK DIMENSIONS: 7/6 x 12 HGH.

COST FOR TANK & CONNECTIONS = \$75/TON-HR × 6000 TON-HR = \$450,000

TANK DIMENSIONS:

76' X76' X14'

Trane Air Conditioning Economics	AREA ALT # 2	6000 TON-HRS STORAGE
By: Trane Customer Direct Service Network	(Discharge from	pump - 39,3 KW
MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2.	(Discharge from STOPAKE 15	COND PUMP - 25.5 KW
ALIERNATIVE X.	7Am 706pm)	CHILLER - 0.8 KW/TON/O:
MONTHLY	ENERGY CONSILM	PTION

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	WATER (1000 GL)	LITES + MISC EQUIP	MT. ON PEAK. CHW EQUIMENT IEM
Jan	311,311	894	64	828,2	CG4-575.2 - 67.8KM
Feb	282,470	894	62	1	211 2241 -
March	337,144	925	117		894-828.2 = 65.8 KW
April	330,373	931	212	İ	925-828.2 = 96.8 KM
May	424,782	948	565		, ,
June	466,381	963	765		
July	480,971	981	852	1	948 - 828.2 = 119.816h
Aug	497,259	977	828	1	963 - 828, 2 = 134, 8K"
Sept	411,115	971	559	1	981 - 858.2 = 152,8 Kh
0ct	357,497	946	241	1	971 - 828.2 = 148.8 KW
Nov	306,096	926	101	1	(-14
Dec	306,247	894	73		446 - 423
Total	4,511,648	. 981	4,441	₩	sar - Plesz = USIFKW
Building Energ	Prgy Consumption = y Consumption =	50,76 152,1	05 (8tw/Sq Ft/Yea 31 (8tw/Sq Ft/Yea	r) Floor Area =	303,682 (Sq Ft)

Z MONTHLY KW FOR CHW EQUIPMENT = 1213.8 KW

สอดเมลิสส์เ

Trane Air Conditioning Economics
By: Trane Customer Direct Service Network

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 之

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THEOMAL STORAGE

V 600 PAGE

EQUIPMENT ENERGY CONSUMPTION-----

14-61	m Code	_	lan	feb	м.			Monthly	Cons	umptio	n						
	•	•	1411	red	Mer	Αţ	פר ו	fay J	une	July			Sep	Oct	No		
(O LIGHTS											_			NO	V Dec	Tota
	ELEC	1206	88 109	398 13°	044	11574	0 470										
	PK	495	.7 49	5.7 49	5.7	495.		76 125		116073		64 115	768 129	876	11462	3 116073	4 44 4
						773,	7 473	.7 49	5.7	495,7	495	.7 495	.7 49	5.7	495.		1,447,841
1	MISC LD															773.1	495.7
	ELEC	12610	00 1140	63 130	921	12151	T 1205	11 1261									
	PK	332,	5 332	.5 33	2.5	332.	332	!! 1261 # 754		23918	13092		13 128	S11	121056	123918	4 /44 4
_							, ,,,,	.5 332	.5	332.5	332.	5 332		2.5	332.5		1,497,052
2	MI2C TD															-74.2	332.5
	GAS		0	0	0	O)	0	^	_							
	PK	٥,	0 0	.۵ (.0	0.0			0 0.	0		0	Đ	0	0	0	•
7	MISC LD						-,	.	. U	0.0	0.4) g.	.0 (.0	0.0	0.0	0 0.0
,	OIT WISC TO																0.0
	PK	(0	0	0		0	0	0			_				
	,,	0.0	0.	0 0	.0	0.0	0.4			0.0	0.0		0	0	0	0	0
4	MISC LD										0.0	v U.	0 0	.0	0.0	0.0	0.0
	P STEAM	٥		_													
	PK	0.0		0	0	0	C		0	Q	0	,	,				
		0,0	0.0	0.	0	0.0	0.0	0.1	3	0.0	0.0	0.0		0	0	0	
5	MISC LD											0.0	, 0,	U	0.0	0.0	0.0
	P HOTHZO	Q	C	,	^												
1	PK	0.0	0.0		0 n	0.0	. 0	0		0	0	٥	1	0	0		
				U.	,	0.0	0.0	0.0		0.0	0.0	0.0			0.0	0 0.0	0
6 1	MISC LD														0.0	0.0	0.0
	B CHIFF	0	0	()	Q	6	_									
F	K	0.0	0.0	0.0		0.0	0.0	0		0	0	0)	O	C	_
						V.U	0.0	0.0	1	0.0	0.0	0.0	0.0)	0.0	0.0	0
	Q1001s		2-5	STG CTV	< 5 55	TONS										-,,	0.0
	LEC	12026	11047			139	39194	49766	= / /								
P	K	126.1	126.1	127.6		3.9	134.3	138.8	564 144		4875	40981	21782	• •	380	12278	348,272
	95100							.50.0	144)	43.3	141.9	134,3	12			60] 144.5
	LEC LEC		COO	LING TO	∤ER											C =1	60) .44.2
Pk		422	396	815	16	78	4164	5529	59	26 :	714	-					
,,	`	13.6	13.6	13.6	14	.2	14.2	14.2	14	_	4.2	5529	3077		694	417	34,363 /
EC	5100		•						• ,		716	14.2	14.2	1.	3.6	13.6 5=	167.4 16.2
	TER	50		ING TO												٠-	, - , - ,
PK		0.7	47 0.7	70		99	203	254	27	77	270	204	104				
		٠,,	0.7	0.7	0.	.7	0.7	0.7	0.		0.7	0.7	106 0.7		64	52	1,697
EQ:	5001		CHI	150 112								4.7	0.7	·	7.7	0.7	0.7
ELE	EC	29239	26410	LED WAT 29239													
PK		39.3	39.3	39.3	2829 39.		9239	28296	2923		239	28296	29239	282	۰ ۵۵	9239	.
				-7.5	J9.	3	39.3	39,3	39.	3 39	7.3	39.3	39.3	39	-		344,268
EQ5			COND	ENSER WA	TER P	UMP r	v							-,		""Z=4	71.6 39.3
ELE			17136	18972	1836		.	19740	480	_						_	
PK		25.5	25,5					18360	18972	2 189	72 1	8360	18972	407			
• •			ر, رے	25.5	25.	5	25.5	25.5	25.5			25.5	10772	1836	אך טכ	972	223,380

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2

					_									
	1 FQS300	Co	NTROL	PANE	L & J	NTERL	ock.							
	PK PK	744 1.0	672 1.0	744 1.0	720 1.0	744 1.0	720 1.0	744 1.0	744 1.0	720	744	720	744	8,760 ×
	2 EG1001S ELEC		2-\$	TG CTV <	555 TONS		.,,	7.0	1.0	1.0	1.0	1.0	1.0 \{\gamma=\infty}	1.0
	PK	2753 158.6	2948 215.8	9072 273.3	21425 276.2	70216 287.8	100925 297.4	117310 309.7	113837 307.0	72134 304.1	26252 287.8	7310 274.2	4096 ⁻ 242 . 5	548,278 V
	2 EQ5100		COOI	LING TOWE	R								Z=32	309.7 4 4
	PK PK	334 22.4	373 26.9	916 29,2	2384 30,4	7609 30.4	10755 30.4	11940 30.4	11515 30.4	7565 30.4	2947 30.4	610 29.1	478	57.426 V
2	E95100		COOL	ING TOWE	R								28.2 = 348	30.4
	Water PK	14 0.9	15 1.2	47 1.4	113 1.5	363 1.5	511 1.5	575 1.5	558 1.5	35 5	135 1.5	37	21	2,744
2	EQ5001		CHILI	ED HATE	.					1.2	1.5	1.4	1.3	1.5
	ELEC PK	0.0	0.0	LED WATER 0 0.0	0.0	.v. 0 0.0	0.0	0 0.0	0.0	0	0	0	Q	0
2	E05010						***	0.0	U.U	0.0	0.0	0.0	0.0	0.0
	ELEC PK	0 0.0	O.O CONDE	NSER WAT O O.O	0	0	0	0	٥	0	0	D	_	
-	E4694-			0.0	0.0	0.0	0.0	0.0	0,0	0.0	0.0	0.0	0 0.0	0
	ELEC	31	28	DL PANEL 54	& INTER	.ock 256	354	707					7.12	0.0
	PK	1.0	1.0	1.0	1.0	1.0		393 1.0	379 1.0	249 1.0	97 1.0	46 1.0	31 1.0 ⊱	2,008 ^V
	E04000 ELEC		PREVEN	ITS FAN E	NERGY								1.0 =12	1.0
	PK	0.0	0.0	0.0	0.0	0.0	0 0.0	0 0.0	0.0	0 0.0	0 0.0	0.0	0.0	0 0.0

15 Km peak = 6,153

TOTAL KIN

Perch 388.4 149.9 510.5 516.5 523.5 547.1 565.6 561.7 557.4 533.5 511.6 H18.7 G155

for com. equi port

COLD THERMAL STORAGE - ALTERNATIVE 2

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE ----

January

			D	esign	
	sign	Cooling	Chiller	Chiller	Storage
OADB	CAWB	Load	Load	Demand	Capacity
(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)
32.8	22.9	0.0	0.0	0.0	6,000
31.5	21.9	0.0	0.0	0.0	6,000
30.4	20.9	3.2	0.0	0.0	6,000
29.6	20.4	5.2	5.2	6.6	6,000
29.4	20.0	5.2	5.2		6,000
29.9	20.7	5.2	5.2	6.6	6,000
31.2	22.0	16.4	16.4	20.8	6,000
33.6	24.0	18.8	0.0	0.0	5,981
37.0	26.5	21.4	0.0	0.0	5,960
40.9	28.5	25.7	0.0	0.0	5,934
45.4	30.7	29.3	0.0	0.0	5,905
49.6	34.1	32.0	0.0	0.0	5,873
52.7	36.1	32.6	0.0	0.0	5,840
54.8	36.7	35.5	0.0	0.0	5,805
55.6	37.2	36.8	0.0	0.0	5,768
54.8	36.8	38.3	0.0	0.0	5,729
53.0	3 5.6	51.9	0.0	0.0	5,678
50.1	34.0	44.0	0.0	0.0	5,634
46.7	31.7	36.1	402.6	284.7	6,000
43.3	29.9	21.9	21.9	24.0	6,000
40.4	28.1	17.7	17.7	22.3	6,000
37.8	26.4	17.1	17.1	21.8	6,000
35.7	24.9	16.9	16.9	21.5	6,000
34.1	23.9	16.6	16.6	21.1	6,000
	OADB (F) 32.8 31.5 30.4 29.6 29.4 29.9 31.2 33.6 37.0 40.9 45.4 49.6 52.7 54.8 55.6 54.8 53.0 146.7 43.3 40.4 37.8 35.7	(F) (F) 32.8 22.9 31.5 21.9 30.4 20.9 29.6 20.4 29.4 20.0 29.9 20.7 31.2 22.0 33.6 24.0 37.0 26.5 40.9 28.5 45.4 30.7 49.6 34.1 52.7 36.1 54.8 36.7 55.6 37.2 54.8 36.8 53.0 35.6 50.1 34.0 46.7 31.7 43.3 29.9 40.4 28.1 37.8 26.4 35.7 24.9	OADB OAWB Load (F) (F) (Ton) 32.8 22.9 0.0 31.5 21.9 0.0 30.4 20.9 3.2 29.6 20.4 5.2 29.4 20.0 5.2 29.9 20.7 5.2 31.2 22.0 16.4 33.6 24.0 18.8 37.0 26.5 21.4 40.9 28.5 25.7 45.4 30.7 29.3 49.6 34.1 32.0 52.7 36.1 32.6 54.8 36.7 35.5 55.6 37.2 36.8 54.8 36.8 38.3 53.0 35.6 51.9 50.1 34.0 44.0 46.7 31.7 36.1 43.3 29.9 21.9 40.4 28.1 17.7 37.8 26.4 17.1 35.7 24.9 16.9	Design (ADB) Cooling (Chiller (CADB) Coad (CADB) Cooling (CADB) Chiller (CADB) 32.8 22.9 0.0 0.0 31.5 21.9 0.0 0.0 30.4 20.9 3.2 0.0 29.6 20.4 5.2 5.2 29.9 20.7 5.2 5.2 29.9 20.7 5.2 5.2 29.9 20.7 5.2 5.2 31.2 22.0 16.4 16.4 33.6 24.0 18.8 0.0 37.0 26.5 21.4 0.0 40.9 28.5 25.7 0.0 45.4 30.7 29.3 0.0 52.7 36.1 32.6 0.0 54.8 36.7 35.5 0.0 55.6 37.2 36.8 0.0 54.8 36.8 38.3 0.0 55.6 37.2 36.8 0.0 55.6 37.2	OADB OAWB Load Load Demand (F) (F) (Ton) (Ton) (Ew) 32.8 22.9 0.0 0.0 0.0 31.5 21.9 0.0 0.0 0.0 30.4 20.9 3.2 0.0 0.0 29.6 20.4 5.2 5.2 6.6 29.4 20.0 5.2 5.2 6.6 29.9 20.7 5.2 5.2 6.6 31.2 22.0 16.4 16.4 20.8 33.6 24.0 18.8 0.0 0.0 37.0 26.5 21.4 0.0 0.0 40.9 28.5 25.7 0.0 0.0 49.6 34.1 32.0 0.0 0.0 52.7 36.1 32.6 0.0 0.0 54.8 36.7 35.5 0.0 0.0 55.6 37.2 36.8 0.0 0.0

----- Weekday ---------- Saturday -----Cooling Chiller Typical Chiller Storage Chiller Cooling Chiller Storage OADB OAWB Load Load Demand Capacity Load Load Demand Capacity Hour (F) (F) (Ton) (Ton) (kW) (Ton-Hr) (Ton) (Ton) (kW) (Ton-Hr) 1 36.9 28.0 16.7 16.7 21.2 6,000 16.7 16.7 21.2 6,000 2 34.1 25.7 16.4 16.4 20.9 6,000 16.5 16.5 20.9 6,000 23.5 3 31.6 16.2 16.2 20.6 6,000 16.3 16.3 20.6 6,000 29.5 21.9 16.0 16.0 20.3 6,000 16.0 16.0 20.4 6,000 5 28.0 20.5 15.9 15.9 20.1 6,000 15.9 15.9 20.2 6,000 6 27.0 20.1 15.7 15.7 20.0 6,000 15.7 15.7 20.0 6,000 7 26.7 20.4 15.6 15.6 19.8 6,000 15.6 15.6 19.9 6,000 8 27.3 21.4 15.7 0.0 0.0 5,984 15.6 0.0 0.0 5,984 9 29.2 23.1 17.6 0.0 5,967 0.0 15.6 0.0 0.0 5,969 10 32.1 24.4 20.6 0.0 0.0 5,946 15.7 0.0 0.0 5,953 11 35.8 26.3 23.3 0.0 0.0 5,923 15.9 0.0 0.0 5,937 12 39.8 28.8 25.1 0.0 0.0 5,898 16.2 0.0 0.0 5,921 13 43.9 31.5 27.8 0.0 0.0 5,870 16.4 0.0 0.0 5,905 14 47.5 33.8 29.3 0.0 0.0 5,840 16.6 0.0 0.0

mmmi

5,888

	A-	して、本・	2.							
16	52.3	35.9 37.3 37.7		0.0 0.0 0.0	a.o o.o o.o	5,809 5,775 5,741	- 16.9 17.1 17.3	0.0 0.0 0.0	0.0 0.0 0.0	5,871 5,854 5,837

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Trane Air Conditioning Economics By: Trane Customer Direct Service Network

COLD THERMAL STORAGE - ALTERNATIVE 2

V 600 PAGE 5

			*****	<u>u</u>	eekdav					
		Typical	Cooling	Chiller	Chiller	Storage	Canlin		aturday	••••••
		DB CAW			Demand	Capacity				Storage
HO	ur (F) (F) (Ton)	(Ton)	(k₩)	(Ton-Hr)				Capacity
					\n_ _j	(1011-47)	(Ton)	(Ton)	(kW)	(Ton-Hr)
	18 52	.6 37,	36,8	0.0	0.0	5,705				
	19 51.		39.6	334.9	242.3	6,000	17.4		0.0	5,819
	20 50.		30.1	30.1	27.3	=	17.5		159.3	6,000
	1 48,		26.6	26.6	25.9	6,000	17.4	17.4	22.1	6,000
	2 45.			24.7	25.1	6,000	17.4	17.4	22.0	6,000
	3 42.	7 32.9	22.6	22.6	24.2	6,000	17.2	17.2	21.9	6,000
2	4 39.	8 30.3	22.0	22.0	24.0	6,000	17.0	17.0	21.6	6,000
						6,000	16.8	16.8	21.4	6,000
				SL	inday			44		
		Typical	Cool ing	Chiller	Chiller	Storage	Coating	chill-	anday	
	QADI		Load	Load	Demand	Capacity	Load		Chiller	Storage
Hour	` (F)) (F)	(Tan)	(Ton)	(kH)	(Ton-Hr)	(Ton)	Load	Demand	Capacity
					•		CION	(Ton)	(kW)	(Ton-Hr)
1	00		16.7	16.7	21.1	6,000	16.6	44.		
2			16.5	16.5	20.9	6,000	16.4	16.6	21.1	6,000
3			16.3	16.3	20.6	6,000	16.2	16.4	20.9	6,000
4 5	0		16.0	16.0	20.4	6,000	16.0	16.2	20.6	6,000
6			15.9	15.9	20.2	6,000	15.9	16.0	20.3	6,000
	27.0	20.1	15.7	15.7	20.0	6,000	15.7	15.9	20.1	6,000
7	26.7		15.6	15.6	19.9	6,000	15.6	15.7	19.9	6,000
8	27.3	21.4	15.6	0.0	0.0	5,984	15.7	15.6	19.8	6,000
9	29.2	23.1	15.6	0.0	0.0	5,969	17.6	0.0	0.0	5,984
10	32.1	24.4	15.7	0.0	0.0	5,953	20.6	0.0	0.0	5,967
11	35.8	26.3	15,9	0.0	0.0	5,937	23.3	0.0	0.0	5,946
12	39.8	28.8	16.2	0.0	0.0	5,921	25.1	0,0	0.0	5,923
13	43.9	31.5	16.4	0.0	0.0	5,905	27.8	0.0	0.0	5,898
14	47.5	33.8	16.6	0.0	0.0	5,888	29.3	0.0	0.0	5,870
15	50.4	35.9	16.9	0.0	0.0	5,871	31.9	0.0	0.0	5,841
16	52.3	37.3	17.1	0.0	0.0	5,854	33.2	0.0	0.0	5,809
17 18	52.9	37.7	17.3	0.0	0.0	5,837	33.9	0.0 0.0	0.0	5,775
	52.6	37.9	17.4	0.0	0.0	5,819	34.1		0.0	5,741
19	51.6	38.7		198.2	159.3	6,000		0.0	0.0	5,707
20	50.1	38.3	17.4	17.4	22.1	6,000	21.6		237.6	6,000
21	48.0	37.0	17.4	17.4	22.0	6,000	18.6	21.6	23.8	6,000
22	45.5	35.2	17.2	17.2	21.9	6,000	17,2	18.6	22.6	6,000
23	42.7	32.9	17.0	17.0	21.6	6,000	17.0	17.2	21.8	6,000
24	39.8	30.3	16.8	16.8	21.4	6,000	16.8	17.0	21.6	6,000

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16.8

16.8

21.3

6,000

COLD THERMAL STORAGE - ALTERNATIVE 2

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE.

July

				(esign	•
	De	esign	Cooling	Chiller	Chiller	Storage
	CADE		Load	Load	Demand	Capacity
Hour	· (F)	(F)	(Tan)	(Ton)	(k⊌)	(Ton-Hr)
1			210.2	550.0	418.8	7 520
2		55.8	184.9	550.0	417.3	3,529
3		55.5	156.9	550.0	416.6	3,894
4	76.5	55.1	136.6	550.0	415.7	4,287
5	76.3	55.9	124.2	550.0	417.5	4,701
6	76.7	56.8	115.1	550.0	419.8	5,126
7	77,8	57.7	149.3	550.0		5,561
8	79.8	57.9	200.3	0.0	422.1	5,962
9	82.6	59.0	318.7	0.0	0.0	5,762
10	85.8	60.3	396.4	0.0	0.0	5,443
11	89.5	61.3	467.7	0.0	0.0	5,047
12	93.0	62,7	517,6	0.0	0.0	4,579
13	95.6	63.5	541.1	0.0	0.0	4,061
14	97.3	63,9	559.7	0.0	0.0	3,520
15	98.0	64.0	568.6	-	0.0	2,961
16	97.3	63.6	577.2	0.0	0.0	2,392
17	95.8	62.6	538.7	0.0	0.0	1,815
18	93.4	61.3	500.2	0.0	0.0	1,276
19	90.6	60.1	473.8	0.0	0.0	776
20	87.8	58.5	397.9	550.0	428.8	852
21	85.4	57.9		550.0	424.3	1,004
22	83.2	57.5	357.0	550.0	422.6	1,197
23	81.5	57.3	318.5	550.0	421.6	1,429
24	80.2	56.9	275.1	550.0	421.0	1,704
		20.7	243.4	550.0	420.0	2,010

	Ţ.	ypical			ekday	******	••	· · · · · · · · · · · · · · · · · · ·	iturday	
Hour	QADB (F)	CAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Domand (kW)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
1 2 3 4 5 6 7 8 9 10 11 12 13 14	79.5 77.5 75.7 74.4 73.6 73.4 73.9 75.4 77.9 80.9 84.3 87.6 90.7 93.1	63.5 62.1 61.1 60.2 60.9 61.6 62.1 61.8 62.6 63.8 64.4 65.8 66.9 67.6	199.1 176.8 156.1 130.3 115.9 103.6 137.0 189.5 303.9 367.0 429.8 476.3 504.4 525.9	550.0 550.0 550.0 550.0 550.0 550.0 0.0	439.4 434.9 431.8 429.1 431.2 433.3 434.9 0.0 0.0 0.0 0.0 0.0	2,361 2,734 3,128 3,548 3,982 4,428 4,841 4,652 4,348 3,981 3,551 3,075 2,571 2,045	217.8 184.4 162.7 136.6 121.1 108.3 101.1 114.0 175.3 216.2 265.8 305.3 297.0 310.2	550.0 550.0 550.0 550.0 550.0 550.0 0.0	439.4 434.9 431.8 429.1 431.2 433.3 434.9 0.0 0.0 0.0	1,599 1,964 2,352 2,765 3,194 3,636 4,085 3,971 3,795 3,579 3,313 3,008 2,711 2,401

15	94.6	68.3	539.6	0.0	0_0	1,505	310 Y			
16	95.1	68.6	552.9	0.0	0.0	952	317.7	0.0	0.0	2,081
17	94.9	68.4	514.1	0.0	0.0	732	327.5	0.0	0.0	1,753
				0.0	0.0	438	341.9	0.0	0.0	1 412

12JUZI/UZZ

COLD THERMAL STORAGE - ALTERNATIVE Z

				We	ekday	•		Sa	iturday	
	Ty	ypical	Cooling	Chiller	Chiller	Storage		Chiller		Storage
	OADB	OAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
										•
18	94.1	67.9	476.6	38.6	34.0	0	343.8	0.0	0.0	1,068
19	92.8	67.8	457.8	550.0	454.2	92	345.7	550.0	454.2	1,272
20	91.0	66.7	382.9	550.0	450.3	259	326.9	550.0	450.3	1,495
21	89.0	66.7	344.1	550.0	450.3	465	303.4	550.0	450.3	1,742
22	86.7	66.5	313.0	550.0	449.6	702	282.7	550.0	449.6	2,009
23	84.3	66.1	282.7	550.0	448.2	970	261.0	550.0	448.2	2,298
24	81.8	65.0	253.2	550.0	444.4	1,266	228.8	550.0	444.4	2,619
				_						
	Ψ.,	miaal								
	OADB	pical		Chiller		Storage	•	Chiller		Storage
Hour	(F)	OAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
11001	(1)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	79.5	63.5	203.8	550.0	439.4	2,966	211.6	550.0	439.4	4,595
2	77.5	62.1	176.4	550.0	434.9	3,339	180.0	550.0	434.9	4,965
3	75.7	61.1	153.4	550.0	431.8	3,736	153.2	550.0	431.8	5,362
4	74.4	60.2	136.7	550.0	429.1	4,149	132.7	550.0	429.1	5,779
5	73.6	60.9	121.2	550.0	431.2	4,578	117.2	338.3	257.3	6,000
6	73.4	61.6	108.4	550.0	433.3	5,019	104.5	104.5	67.3	6,000
7	73.9	62.1	101.1	550.0	434.9	5,468	138.1	138.1	91.8	6,000
8	75.4	61.8	114.0	0.0	0.0	5,354	190.9	0.0	0.0	5,809
9	77.9	62.6	138.1	0.0	0.0	5,216	305.1	0.0	0.0	5,504
10	80.9	63.8	170.2	0.0	0.0	5,046	367.8	0.0	0.0	5,136
11	84.3	64.4	211.1	0.0	0.0	4,835	430.7	0.0	0.0	4,706
12	87.6	65.8	241.8	0.0	0.0	4,593	476.7	0.0	0.0	4,229
13	90.7	66.9	270.9	0.0	0.0	4,322	504.7	0.0	0.0	3,724
14	93.1	67.6	293.0	0.0	0.0	4,029	526.2	0.0	0.0	3,198
15	94.6	68.3	311.1	0.0	0.0	3,718	539.8	0.0	0.0	2,658
16	95.1	68.6	327.5	0.0	0.0	3,391	552.9	0.0	0.0	2,105
17	94.9	68.4	341.9	0.0	0.0	3,049	514.2	0.0	0.0	1,591
18	94.1	67.9	343.8	0.0	0.0	2,705	476.6	0.0	0.0	1,114
19	92.8	67.8	345.6	550.0	454.2	2,909	457.8	550.0	454.2	1,207
20	91.0	66.7	326.9	550.0	450.3	3,132	382.9	550.0	450.3	1,374
21	89.0	66.7	303.4	550.0	450.3	3,379	344.1	550.0	450.3	1,580
22	86.7	66.5	282.7	550.0	449.6	3,646	313.0	550.0	449.6	1,817
23	84.3	66.1	260.9	550.0	448.2	3,935	282.7	550.0	448.2	2,084
24	81.8	65.0	228.8	550.0	444.4	4,256	253.2	550.0	444.4	2,381

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Thermal Storage Technology Overview

Theoretical Storage Volume Requirements

storing thermal energy in a cool storage system: ice, salt phase while storing or releasing heat energy. The third, hydrates and water. The first two undergo a change of Presently, these are three different types of media for water, does not. Each storage media requires some inherent volume and circulation space and assume 100% storage utilization, mass for storing heat energy. If one could neglect the theoretical storage volumes would be:

1.46 ft³/ton-hour

salt hydrate: 3.18 ft³/ton-hour

9.62 ft³/ton-hour

water:

based upon a 20° change in storage temperature, from upon latent heat capacity only. The figure for water is The figures shown for ice and salt storage are based 40° to 60° .

These storage volumes are theoretical only. They are not internal circulation of fluid for heat transfer. While some internal energy is completely usable. These factors result manufacturers would like to have us believe otherwise, necessary to allocate some of the storage volume for gures. For example, these have become commonly obtainable in the field for several reasons. First, it is no thermal storage system is 100% efficient. Not all in actual storage volumes considerably above these accepted:

2.25 to 3.00 ft³/ton-hour <u>:</u>

5.50 to 6.00 ft³/ton-hour salt hydrate:

12.50 to 13.00 ft³/ton-hour

water:

The lower value for ice storage represents a typical value for an encapsulated ice storage vessel; the higher value

storage "floor space" required. Many manufacturers build their systems in round or cylindrical tanks. In these cases, this often is quite minimal since very little if any servicing to the storage itself is ever needed. Some manufacturers' "footprint" of a storage vessel, depending upon whether systems can be directly buried if the vessels are built to Some amount of space is needed for access, however it is oriented in a horizontal or vertical configuration. Storage volumes often do not represent the actual the required floor space is something above the is for an ice harvester system. accommodate this.

were installed vertically, the space requirement would be about 0.063 ft²/ton-hour. This is usually, as mentioned before, not possible unless the tank is outdoors. If installed horizontally, the storage vessel space requirement becomes 0.237 ft²/ton-hour.

A normal required area range for vertical tanks is 0.063^2 /ton-hour for a 45 ft high tank to 0.12^2 for a 25 high tank. Horizontal tanks will need an area of approximately 0.235 to 0.238 ft²/ton hour.

Chilled Water Storage Systems

Chilled water storage systems are really nothing more than a tank of cold water held as close to 40° as possible. Why 40°? Because at this temperature, water is at its greatest density (this actually occurs at 39.2°, but 40° has become the standard minimum design temperature).

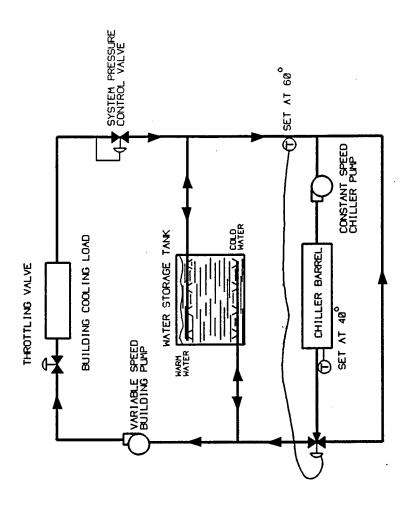
Many chilled water storage systems have been built. Extensive research has been done, and some very fine publications have come out of this effort, most notably that from EPRI. EPRI's publication EM 4852, <u>Stratified Chilled Water Storage Design Guide</u> is probably the most authoritative of all publications thus far. Research has proven that of all storage methods, a single stratified storage tank has the greatest reliability and at the lowest cost.

There is one important consideration about stratified water systems that one must keep in mind. Water returning from the building air-handling unit (cooling coil) MUST always return at a constant temperature (or very close to it). One may deduce from this statement that water flow rates are not constant, but variable. Hence this system would imply variable speed pumping. The only exception to this is the water flow circuit through the chiller itself, which is constant flow. Flow to the building is variable as is flow to the storage tank. Three-way valves on cooling coils cannot be used. If retrofitting an existing system, and it has three way valves, simply close off the bypass ports and cap them.

When retrofitting an existing air handling unit, check to see that it has a chilled water coil of at least 6 rows of tubing with 14 fins per inch. Eight rows are highly recommended. If the coil bank has less than 6 rows, add an additional cooling coil piped in series with the existing coil. If this is not possible, use another cool storage technology.

Manufacturers of stratified chilled water tanks are:

- CBI (Chicago Bridge & Iron Company Stratatherm Div.)
- General Engineering Corp.
- Van Doren Industries



Space Requirements

the overall tank utilization efficiency. Because insulation Depths greater than 12 ft are possible, but add little to The optimum storage tank for a stratified chilled water design the tank so that total surface area is minimized while holding the minimum tank depth to 12 feet as of a water storage tank is so important, it is wise to system is a round tank, no less than 12 feet deep. mentioned before.

depth and a 90% tank utilization, the required surface area will range between 1.043 ft 2 to 1.05 ft 2 per Based upon 6" of insulation on top and sides, a 12 ft ton-hour. This area is for a rectangular tank.

a change in its phase during the heat transfer process is a phase change material" - any substance that undergoes technology, except a higher temperature phase-change definition, when its goes from its liquid to solid phases. phase change material. For example, water meets this This concept is quite similar to the encapsulated ice naterial (PCM) is used. (Note the used of the term n so doing, its absorbs 144 btu/lb in the process.) Salt Hydrate Systems

This This

storage medium. One freezes at 47°, the other at 41°. In a salt hydrate system, a proprietary salt mixture is phase-change temperatures, can be selected as the used. Two types of salts, each having difference

Demand & Energy of Thermal Storage Technologies⁽¹⁾

		- TO STORAC	ACE				2	
	PEAK DAY, KW/TON	5	SEASONAL, KWh/TON-HR	TON-HR	PEAK DAY, KW/TON	VION SEA	SEASONAL, KWh/TON-HR	/TON-HR
TECHNOLOGY	01	Ī	0]	Ξ	01	I	01	H
CHILLED WATER STORAGE ⁽³⁾ 1.00	1.00	1.10	0.75	0.95	0.95	1.05	0.65	0.95
SALT HYDRATE ⁽³⁾	0.85	1.10	0.65	0.95	0.95	1.05	0.65	0.95
ICE HARVESTER ⁽²⁾	0.95	1.50	0.80	1.10	0.75	0.95	0.50	0.95
B&R ICE ⁽³⁾⁽⁵⁾	1.00	1.60	0.95	1.25	0.95	1.05	0.65	0.80

⁽¹⁾ All figures include allowances for condenser or cooling tower fans, condenser and chilled water pump(s). "LO" figures are for evaporative-cooled equipment; "HI" figures are for water-cooled equipment. If air-cooled equipment is used, multiply ranges shown by 1.35.

ပုံ (2) "LO" figures are for systems with refrigerant liquid overfeed, hi-side drainers and screw compressors with floating head pressure - see text. လို (3) Water-cooled chillers, either reciprocating, screw or centrifugal, with constant condenser water inlet temperatures will exhibit values 1.5 to 2.5 times figures shown.

⁽⁴⁾ On-peak demand for load shifting systems will range between 0.03 to 0.05 kW/ton for operation of chilled water pump(s).

⁽⁵⁾ B&R Ice = Brine & Refrigerant Ice

Costs of Thermal Storage Systems

\$/TON-HOUR CONCEPI

\$60-\$85 (An average of #7500, is used.)

\$125 - \$145 \$100 - \$120 chilled water salt hydrate harvester

With the exception of the ice harvester, the balance of completely packaged unit and includes a storage tank. these concepts do not include cost for a refrigeration plant. The harvester does. The harvester system is a \$65 - \$100 brine/refg ice

All costs assume an "easy" installation, the storage system located immediately adjacent an outside equipment room wall.

LIFE CYCLE COST ANALYSIS SUMMARY **ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

		LOCATION: Whit	e Sands Missile	Range	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
		PROJECT TITLE:	TECH AREA C	HILLER PLANT (ALT 3)			FISCAL YEAR:	1992
		DISCRETE PORTI	ON NAME:	TOTAL				
		ANALYSIS DATE:	11/11/92		ECONOMIC LIFE:	25	PREPARED BY:	T. FORSTER
1	IN۱	VESTMENT						
	A.	CONSTRUCTION	COST	=			\$4,813,733	
	В.	SIOH COST		(5.5% of 1A) =			\$264,755	
	C.	DESIGN COST		(6.0% of 1A) =			\$288,824	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$5,367,312	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$5,367,312
2	EN	IERGY SAVINGS (+)	/ COST (_)					
-	CIV	FUEL TYPE	FUEL COST	CAVINCE	ANINILIAI	DISCOUNT	DISCOUNTED	
		POELTIPE		SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
	٨	ELEC	\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
		DIST	\$6.48	6,146 0	\$39,796	15.23 17.28	\$606,091	
		NAT GAS	\$2.21	(57,062)	\$0 (\$128,244)		\$0 (\$2,479,432)	
		PAPER	42.2 1	(57,502)	(\$120,244)	18.04	(\$2,479,432)	
	-	COAL		v	\$0	16.22	\$0	
	F.	TOTAL		(50,916)	·		 >	(\$1,873,341)
				(,	(,,			(41,070,017)
3	NO	N-ENERGY SAVIN	GS (+) / COST (-	-)				
	A.	ANNUAL RECURF	ING (+/-) (ELEC	DEMAND SAVINGS +	=		\$84,043	
		MAINTENANCE CO	OST SAVINGS)					
		1 DISCOUNT FAC	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	AVINGS (+) / CO	OST (-)	(3A x 3A1) =		\$1,233,751	
	В.	NON-RECURRING	i (+/ -)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. EQUIP REPLAC	EMENT COST	\$100,000	1	0.96	\$96,000	
		b. EQUIP REPLAC	EMENT COST	\$193,500	5	0.80	\$154,800	
		c. EQUIP REPLAC	EMENT COST	\$713,250	10	0.64	\$456,480	
		d TOTAL		\$1,006,750			\$707,280	
				TED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$1,941,031
	D.	PROJECT NON-E						
		1 25% MAXIMUM		CALCULATION		(2F5 x 0.33) =	(\$618,202)	
		a IF 3D1 => 3C 1						
		b IF 3D1 < 3C T		E SIR		(2F5 + 3D1) / 1F =	-0.46	
		c IF 3D1b => 1 T						•
		a 1F3U1b<1Th	IEN PROJECT [DOES NOT QUALIFY				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) / C	COSTS (-)	(2F3	+ 3A + (3B1d/25)) =		\$37,865
5	то	TAL NET DISCOUN	TED SAVINGS			(2F5 + 3C) =		\$67,690
6	DIS	SCOUNTED SAVING	SS-TO-INVEST	MENT RATIO (SIR)		(5/1F) =		0.01
	(II	F SIR < 1 THEN PRO	DJECT DOES NO	OT QUALIFY)				
7	SIN	MPLE PAYBACK (SF	B) YRS			(1F/4) =		142

	CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKD	NWC							
CONTRACTOR	EMC ENGINEERS INC.	:		ADDRESS 2750 SOL	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO 80227	ORTH BLVI	D., #C-200,	DENVER, C	0 80227	
CONTRACT F	CONTRACT FOR (Work to be performed) TECH AREA (ALT 3)						PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		
PURCHASER	PURCHASE REQUEST NUMBER			PROJECT NUMBER	BER		WORK LOCATION WHITE SAN	IDS MISSILE	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	LCOST		LABOR COSTS			
		Cnii	•			9.15-1-1			Other	<u>.</u>
Line	Item	of Measure	Quantity	Unit	Total	Mannours	Average Rate	Total	Costs	Total
-	(1)	(2)	(3)	(4)	(5)	(9)	8	(8)	(6)	(10)
,	200 TON CENT. CHILLER W/ STEAM TURBINE 400 TON CENT. CHILLER W/ STEAM TURBINE	LUMP SUM		280000	280000					\$280,000
٥	2100 TON COOLING TOWER WITH SUBFACE CONDENSER	LUMP								\$0
, e	PLIMPS, VALVES, ETC.	LUMP		170000	170000					\$170,000
4	2000 SQ.FT. BLDG.	S.	2000	30.00	00009					\$60,000
ဟ D23-	BURIED CWS & CWR PIPING	LUMP		558700	558700					\$558,700
.2 2	VAULT W/EXP. JOINTS, VALVES, ENCHORS, ETC	EA	5	10800	54000					\$54,000
7	INTERCONNECTION @ BLDG.	EA	6	14000	126000					\$126,000
8	GAS TURBINE WITH 875 KW GENERATOR HRSG AND AUX BOILER	EA	-	672400	672400					\$672,400
6	GAS BOOSTER COMPRESSOR	EA	-	75000	75000					\$75,000
10	CONNECTION TO BASE ELECTRICAL SYSTEM ELECTRIC SWITCH GEAR	EA	-	125000	125000					\$125,000
11	STEAM AND CONDENSATE PIPING SYSTEM	EA	-	1170828	1170828					\$1,170,828
12	BUILDING HEATING SYSTEM CONVERVSIONS	EA	-	273830	273830					\$273,830
	SUBTOTAL									\$3,565,758
	OVERHEAD & PROFIT (25%) CONTINGENCY (10%)									\$891,440 \$356,576
	TOTAL THIS SHEET					:				\$4,813,773

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

		LOCATION: White		•	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				CHILLER PLANT (ALT 3)			FISCAL YEAR:	1992
		DISCRETE PORTIO	ON NAME:	TOTAL				
		ANALYSIS DATE:	11/11/92		ECONOMIC LIFE:	25	PREPARED BY:	T. FORSTER
1	IN	VESTMENT						
	A.	CONSTRUCTION	COST	=			\$4,364,493	
	В.	SIOH COST		(5.5% of 1A) =			\$240,047	
	C.	DESIGN COST		(6.0% of 1A) =			\$261,870	
	D.	ENERGY CREDIT		(1A + 1B + 1C) =			\$ 4,868,410	
	E.	SALVAGE VALUE		=			\$0	
	F.	TOTAL INVESTME	NT	(1D - 1E) =			>	\$4,866,410
2	EN	ERGY SAVINGS (+)	/ COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	2,845	\$18,420	15.23	\$280,543	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	(50,716)	(\$112,204)	19.64	(\$2,203,688)	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		(47,871)	(93,783.7)		>	(\$1,923,145)
3	NO	N-ENERGY SAVING	3S (+) / COST (-	-)				
	A.	ANNUAL RECURR	ING (+/-) (ELEC	C. DEMAND SAVINGS +	=		\$22,033	
		MAINTENANCE CO	ST SAVINGS)					
		1 DISCOUNT FACT	TOR		(From Table A-2) =	14.68		
		2 DISCOUNTED SA	AVINGS (+) / CO	OST (-)	(3A x 3A1) =		\$ 323,444	
	В.	NON-RECURRING	i (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. EQUIP REPLAC	EMENT COST	\$100,000	1	0.96	\$96,000	
		b. EQUIP REPLAC	EMENT COST	\$193,500	5	0.80	\$154,800	
		c. EQUIP REPLACE	EMENT COST	\$ 713,250	10	0.64	\$456,480	
		d TOTAL		\$1,006,750			\$707,280	
	C.	TOTAL NON-ENER	RGY DISCOUN	TED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$1,030,724
	D.	PROJECT NON-EN	IERGY TEST					
		1 25% MAXIMUM I	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	(\$634,638)	
		a IF 3D1 => 3C T	HEN GO TO 4					
		b IF 3D1 < 3C TH	IEN CALCULAT	TE SIR		(2F5 + 3D1) / 1F =	-0.53	
		c IF 3D1b => 1 Ti						
		d IF 3D1b < 1 TH	EN PROJECT [DOES NOT QUALIFY				
А	EID	RST YEAR DOLLAR S	RAVINGE (1) (C	COSTS (.)	185 -	. 64 . (684.)		
		TAL NET DISCOUNT		,0019 (-)	(2F3	+ 3A + (3B1d/25)) =		(\$31,481)
		SCOUNTED SAVING		MENT RATIO (SID)		(2F5 + 3C) =		(\$892,421)
0		SIR < 1 THEN PRO				(5/1F) =		-0.18
7		/PLE PAYBACK (SPE		OT QUALIFT)		/- - /-		
•	Silv	ייי בבי או מאטת (סדנ)			(1F/4) =		-155

Ouantity (3) (3) 1600 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		CONSTRUCTION COST ESTIMATE BREAKDOWN	BREAKDO	NWC							
PROJECT NUMBERS РРОБЕН ТОТА СОМПТИСТ РЯДЕ CQUAINTITY MATTERNAL COST AND SMISSILE RANGE, NEW MATTER COSTS WOHITE SANDS MISSILE RANGE, NEW MATTER COSTS COHECT AND COSTS COHECT AND COSTS COHECT AND COSTS COHECT AND COSTS COHECT AND COSTS COHECT AND COSTS COSTS COSTS COHECT AND COSTS COSTS	CONTRACTOR EMC ENGINEERS INC.				ADDRESS 2750 SOI	JTH WADSW	ORTH BLV	D., #C-200	, DENVER, C	0 80227	
MATERIAN MOTERIAL CONTINUAL INTERIOR MOTERIAL CONTINUAL CONTINUAL CONTINUAL INTERIOR MOTERIAL CONTINUAL INTERIOR MOT	CONTRACT FOR (Work to be performed) TECH AREA (ALT 3)							PROPOSED TOTA	AL CONTRACT PRICE	411	
Quantity Linit Total Mandays Average Total Other Direct (3) (4) (5) (6) (7) (8) (9) (9) 1 280000 280000 (6) (7) (8) (9) (9) 1 1 280000 280000 (6) (7) (8) (9) (9) 1 1 170000 170000 (7) (8) (9)	PURCHASE REQUEST NUMBER				PROJECT NUM	BER		WORK LOCATION WHITE SA	NDS MISSILE	E RANGE, NE	W MEXICO
Quantity Unit Total Manthours Average Other Costs (3) (4) (5) (6) (7) (8) (9) 1 280000 280000 (6) (7) (8) (9) (9) 1 1 280000 280000 (6) (7) (8) (9		1			MATERIA	L cost		LABOR COSTS			
(3) (4) (5) (6) (7) (9) (9) (9) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1	Item		of lit	Quantity			Manhours	Average		Other Direct	Line
1 280000 280000	v	2	Measure (2)	ල	Unit	Total (5)	Mandays (6)	Rate	Total (8)	Costs (9)	Total (10)
170000 170000	V/ STEAM TURBINE W/ STEAM TURBINE		LUMP		280000	280000					\$280,000
170000 170000 30.00 48000 558700 558700 10800 54000 406600 406600 50000 50000 95000 95000 1170828 1170828 273830 273830	2100 TON COOLING TOWER WITH SURFACE CONDENSER	_	LUMP SUM	-							0\$
30.00 48000 558700 558700 10800 54000 14000 126000 406600 406600 50000 50000 95000 95000 1170828 1170828 273830 273830		-	LUMP SUM	-	170000	170000					\$170,000
558700 558700 10800 54000 406600 406600 50000 50000 95000 95000 1170828 1170828 273830 273830	1600 SQ.FT. BLDG.		R T	1600	30.00	00087					\$48,000
10800 54000 14000 126000 406600 406600 50000 50000 95000 95000 1170828 1170828 273830 273830	BURIED CWS & CWR PIPING SI	<u>∃</u> ∞	LUMP SUM	-	558700	558700					\$558,700
14000 126000 406600 406600 50000 50000 95000 95000 1170828 1170828 273830 273830	VAULT W/EXP. JOINTS, VALVES, ANCHORS, ETC		EA	2	10800	54000					\$54,000
406600 406600 50000 50000 95000 95000 1170828 1170828 273830 273830		ш	EA	6	14000	126000					\$126,000
50000 50000 95000 95000 1170828 1170828 273830 273830	GAS TURBINE WITH 500 KW GENERATOR HRSG AND AUX BOILER EA	Щ	ď	-	406600	406600					\$406,600
95000 95000 1170828 1170828 273830 273830		ш	EA	. 1	50000	20000					\$50,000
1170828 1170828 273830 273830	CONNECTION TO BASE ELECTRICAL SYSTEM ELECTRIC SWITCH GEAR	-	EA	-	95000	95000					\$95,000
273830 273830	STEAM AND CONDENSATE PIPING SYSTEM		EA	-	1170828	1170828					\$1,170,828
\$3,232,958 \$808,240 \$323,296 \$323,296 \$4,364,493	BUILDING HEATING SYSTEM CONVERVSIONS		EA	-	273830	273830					\$273,830
\$808,240 \$323,296 \$4,364,493	SUBTOTAL										\$3,232,958
\$4,364,493	OVERHEAD & PROFIT (25%) CONTINGENCY (10%)										\$808,240 \$323,296
	TOTAL THIS SHEET		·								\$4,364,493

E M C ENGINEERS, INC.

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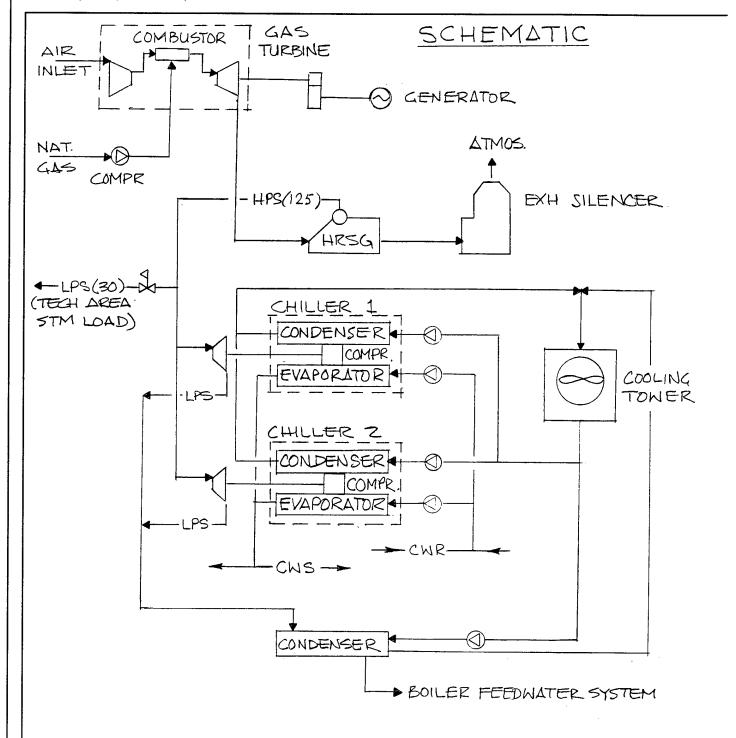
TECH AREA ALT. #3 JOB WSMR ESOS STUDY 1110.000

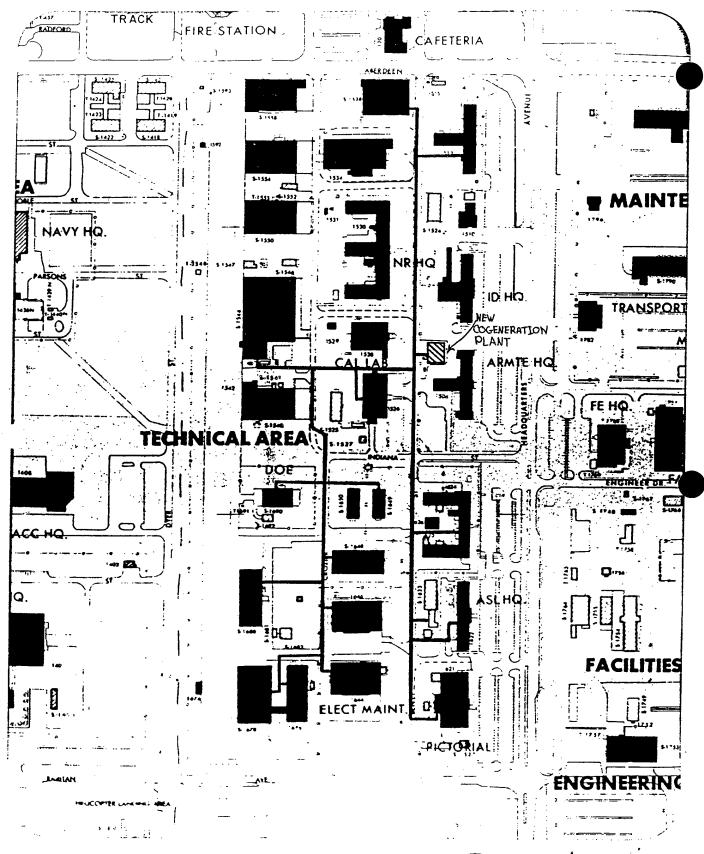
SHEET NO. _____ OF ___ |

CALCULATED BY ____ C. Butley DATE 11/10/92

CHECKED BY ____ TF ____ DATE 11/12/92

SCALE _____





and market

STEAM DISTRIBUTION PIPING

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

JOB	
SHEET NO.	OF
CALCULATED BY	DATE
CHECKED BY	DATE
PCALE	

AT # 3

COST ESTIMATE WORKSHEET

GARRIETT B3)
500 KW GASTURB/GENSET: \$25,000 \$3000 \$333,000
W/FUELCOMMESSON
875 KW GAS TURB/GENSET: \$550,000 \$15,000 \$565,000
(ESTIMATED)

200 TON RUTISCREW
COMP CINCLER W/STM
TURBINE

400 TON R.S.C.W/ STM TURBING

2100 TON COOUNA

PUMS, VALUES, ETC.

HRSG. (4000 LB/HR) HRSG. (7100 LB/HR)

BOILER (12,8 MBtu/Hr)

BOILER (9.1 MBtn/Hr)

SURFACE CONDENSER

EVAP WOLER FOR GITING

270,000 \$10,000 \$290,000

#44,000 #4,400 #48,400

#127,500 #412,500 # 179,000

#23,000 \$5,600 28,600 #56,800 \$12,000 #68,300

\$39,000 \$6,000 \$45,000

*34,000 *4,600 *38,600

#70,000 #6,000 #76,000

\$17,500 \$7,500 \$25,000

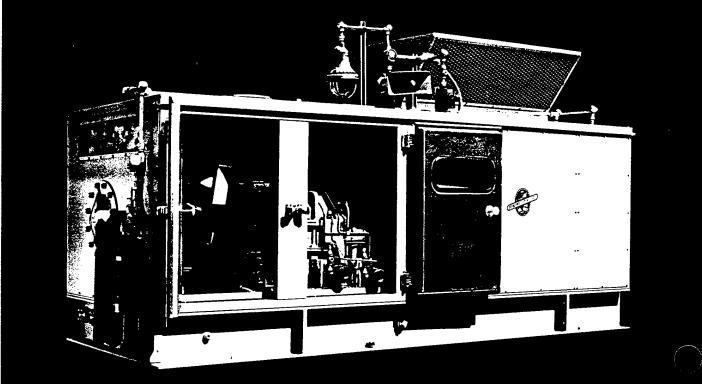
GAS TURBINE PRODUCTS

MODEL GT-500 GAS TURBINE GENERATOR SET



BY

STEWART & STEVENSON SERVICES



TYPICAL GAS TURBINE GENERATOR SET WITH OPTIONAL ENCLOSURE

Specifications

**Continuous rating based on 94% generator efficiency.

(કલ્સર્લકોઇએ) (કલ્સર્લિકોઇએ)

ENGINE	GENERATOR
Manufacturer	TypeDrip Proof
TypeSingle Shaft Gas Turbine	KW**515 KW
Engine Rotor Speed	Power Factor
Main Output Speed 1500/1800 RPM	VoltageAs required
Compressor TypeTwo stage, Centrifugal	Phase
Compression Ratio11:1	Frequency
Turbine Type Three stage, Axial	RPM
Combustor Type Single can	Exciter Brushless
Rating:	
*Stand-by	
*Continuous	
Airflow: At Continuous Rating	
Inlet	
Exhaust16100 CFM (7.89 lbs/sec)	
Exhaust Temp	
Unit Weight (dry)	
*Ratings are based on plus or minus 5% performance at sea	a level and 59°F (15°C) conditions without generators and
duct losses	

STANDARD EQUIPMENT

Garrett IM-831 gas turbine with integral gearbox and couplings

515 KW continuous duty rating brushless type generator 480 V, 3P, 60 Hz

Lube Oil System - Self contained within package except cooler Lube Oil Cooler: Water-to-oil Shell and Tube type for remote mounting

Skid: I-Beam construction, all customer connections at turbine end

Turbine controls and batteries for location in customer control room

Two Stage air inlet filter

Air Inlet silencer

Turbine exhaust expansion joint

Natural Gas Fuel System: 200-210 PSIG required

24 VDC Electrical Starting System

Full load unit performance test (with contract switchgear if desired)

Enclosure: Indoor and outdoor installation w/sound attenuation

OPTIONAL EQUIPMENT (Partial List)

Pneumatic Starting System: Air or Natural Gas 50-150 PSIG Required, 1500 SCFM/Start

Exhaust Silencer

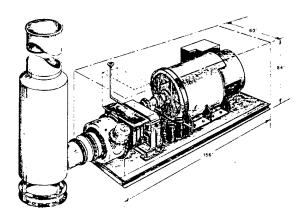
Generator set switchgear with paralleling features and circuit breaker.

Fire/Gas extinguishing and detection system

Liquid Fuel System

.....................................

Diesel #1, Diesel #2, Kerosene, propane

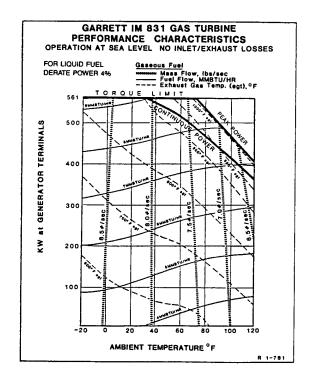


OPTIONAL EQUIPMENT (Continued)

Dual Fuel System: Liquid/natural gas; auto switchover without loss of power during normal operation in the event that primary source of fuel is lost.

Waste Heat Recovery Systems:

Steam Production Refrigeration Desalination



TYPICAL GARRETT 831 GAS TURBINE GENERATOR SET

Specifications and information contained in this brochure subject to change without notice.



STEWART & STEVENSON SERVICES, INC. World Headquarters: 2707 N. Loop West Mailing Address: P.O. Box 1637 Houston, Texas 77251-1637, (713) 868-7700

Offices: Amarillo, Beaumont, Corpus Christi, Dallas, Harlingen, Houston, Lubbock, Odessa, San Antonio, Wichita Falls, TX; New Orleans, LA; Denver, CO; Albuquerque, Farmington, NM; Casper, WY; Arlington, VA; San Francisco, CA; Caracas; Maracaibo; Hong Kong; Al Khobar, Saudia Arabia.

SS-GT-03 (1/89)

FAMOUS FOR SERVICE AROUND THE WORLD



STEWART & STEVENSON

GARRETT IM 831 GAS TURBINE PERFORMANCE CHARACTERISTICS OPERATION AT SEA LEVEL NO INLET/EXHAUST LOSSES

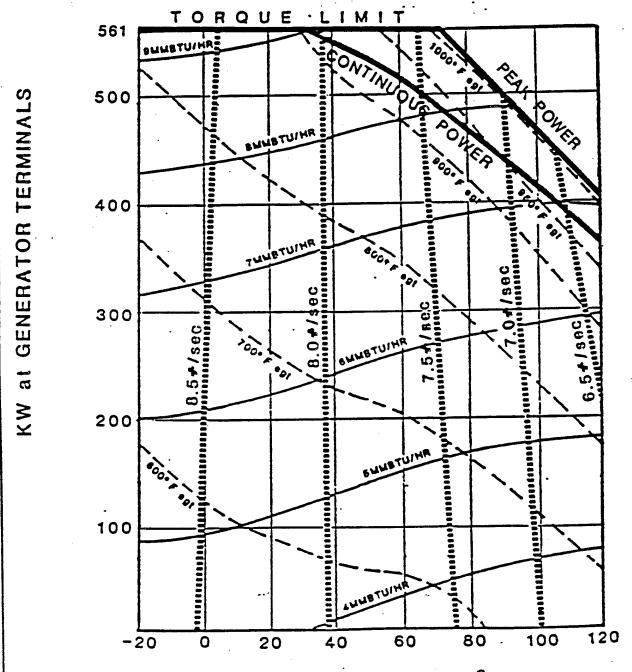
FOR LIQUID FUEL DERATE POWER 4%

Gaseous Fuel

Mass Flow, Ibs/sec

Fuel Flow, MMBTU/HR

--- Exhaust Gas Temp. (egt), °F



AMBIENT TEMPERATURE °F

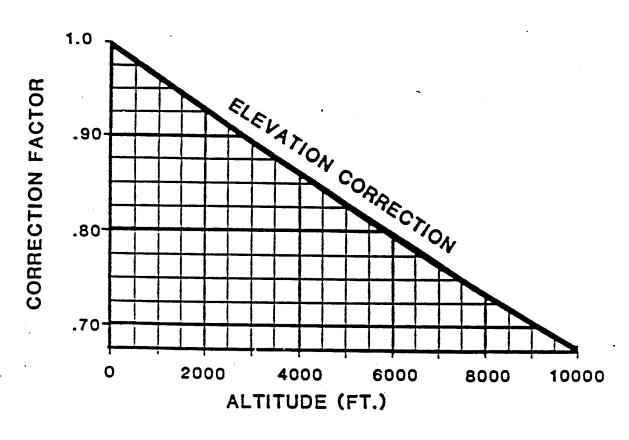
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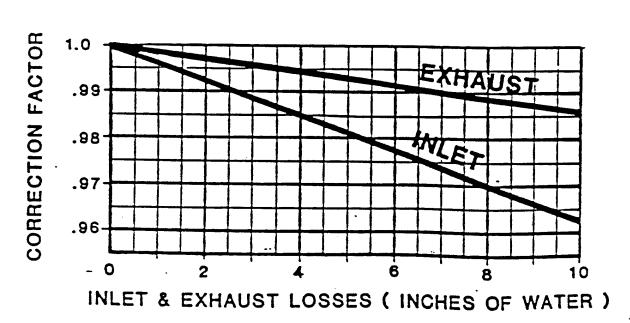


STEWART & STEVENSON



POWER CORRECTION FACTORS FOR GAS TURBINE APPLICATION







15:20

FRY EQUIPMENT CO., INC.

2600 W. 2ND AVENUE SUITE 7 DENVER, COLORADO 80219 PHONE 303-922-8442
FAX: (303) 922-8445

DATE: 4 NOV 92

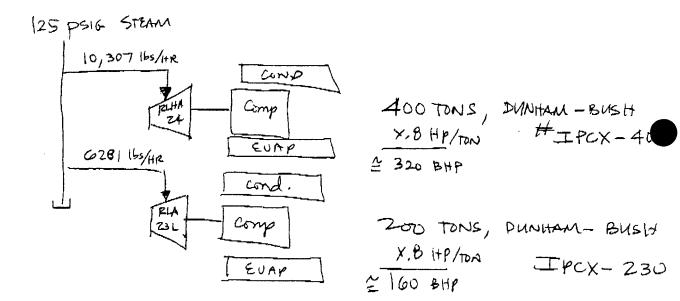
TRANSMITTED TO: ____EMC

ATTENTION: TOM FORSTER FROM: LOW GROWINGS

SUBJECT: SELECTION ON STEAM TURBINES @, 125 -> 0°

This Transmission Consists of ______ Pages Including This Page.

tom:



1- Coppus 12LA-23L TURBINE, 160 HP

BUNET # 18,000

ATY

1- Coppus RLHA-24 TURBINE, 320 HP

BURJET #28,500

COPPUS STEAM TURBINE SELECTION

White Sands Almagordo, N.M. Attn: EMC Engine	eers			User: Drive Coppu	omer ref:	Steam Drive	Chillers
TURBINE DATA: Item no. Frame size				RLA	23L		
Inlet press. Inlet temp. Exhaust press		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	e war e a saar	Norm 125 360 0	•	Units psig •F psig	
PERFORMANCE:	HP		peed rpm	St.rate lb/hp/hr		Exh.temp °F	HV closed
	158 104 52	:	3600 3600 3600	39.8 40.2 41.4	6281 4184 2150	212 212 212	1 5 9
CONSTRUCTION:				LIMI	TS:		
Construction Inlet size Exhaust size Shaft size Hand valves		200 3 8 2.125 9	in. in. in.		otential ax. Power:	214	НР

COMMENTS:

Ver.1.0,1987

COPPUS STEAM TURBINE SELECTION Date: 11-06-1992 Customer ref: Tom Forster, PhD, P.E White Sands Almagordo, N.M. User: Driven equip: Steam Drive Chillers Coppus ref: Fry Equipment Attn: EMC Engineers Agent: Lou Grounds TURBINE DATA: Item no. Frame size RLHA 24 STEAM CONDITIONS: Units Norm 125 psig Inlet press. Inlet temp. 360 0 Exhaust press. psig PERFORMANCE: Speed St.rate Flow rpm lb/hp/hr lb/hr HP lb/hr 360032.210307212360033.06956212360039.54189212 320 211 2 106 LIMITS: CONSTRUCTION: Construction 200 Potential Inlet size 4 Exhaust size 10 in. Max. Power: 480 HP in. Shaft size 2.5 in.

COMMENTS:

Hand valves

<Consult factory for hand valve selection>

Ver.1.0,1987

JOB WSMR ESOS STUDY #1110-000

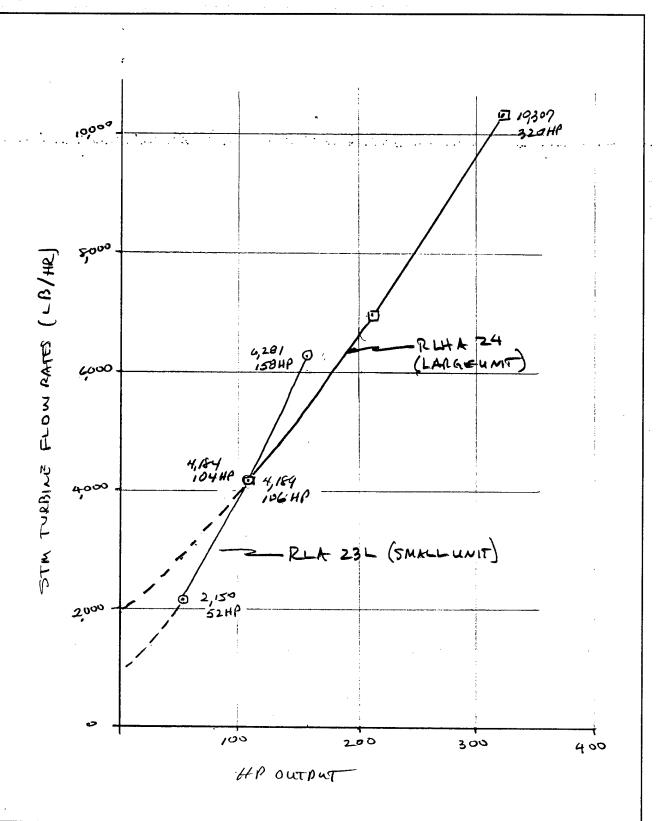
E M C ENGINEERS, INC.

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CALCULATED BY TR DATE 11-06-92

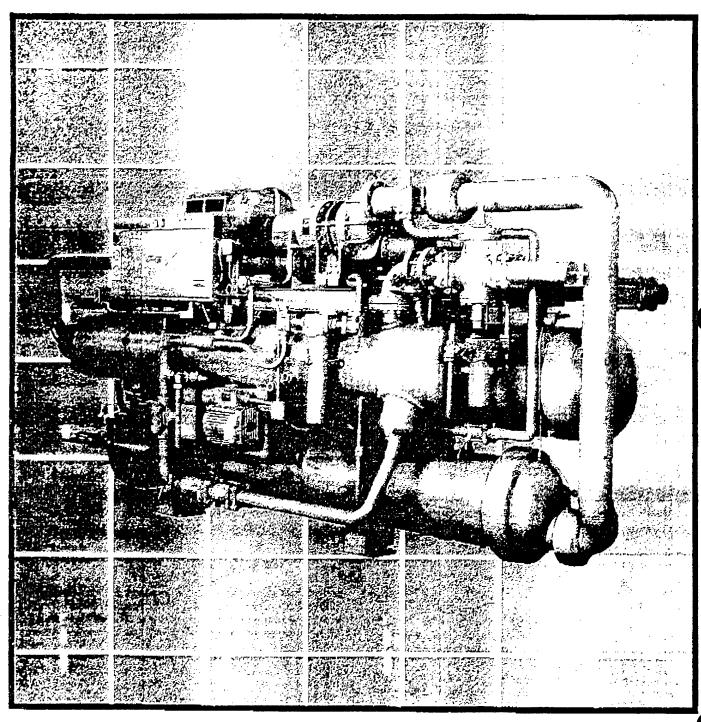
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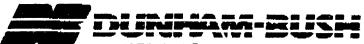
ALT#3 STM TURBINE DERF CURVECALE.



Industrial Packaged Chillers IPCX Water—Cooled 120 Thru 750 Tons

R22 Rotary Screw Compressors





INDUSTRIAL REFRIGERATION DIVISION Products That Perform. By People Who Care.

SELECTION PROCEDURE

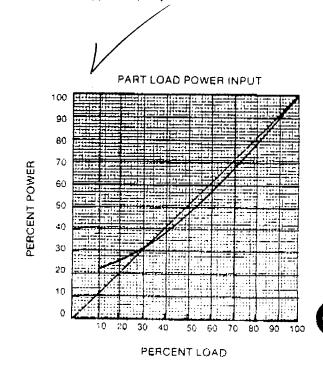
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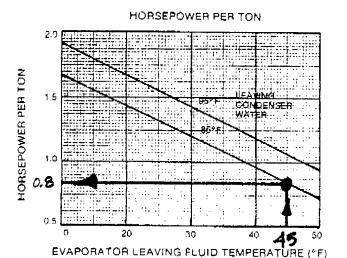
UNIT SELECTION - Selection curves are located below. Unit size is determined by the intersection of the required cooling tons and leaving fluid temperature. Selections are based on an ethylene glycol solution with a freeze point 10° F below the evaporating temperature. Please contact the local Dunham-Bush representative for selections at leaving temperatures below 10° F.

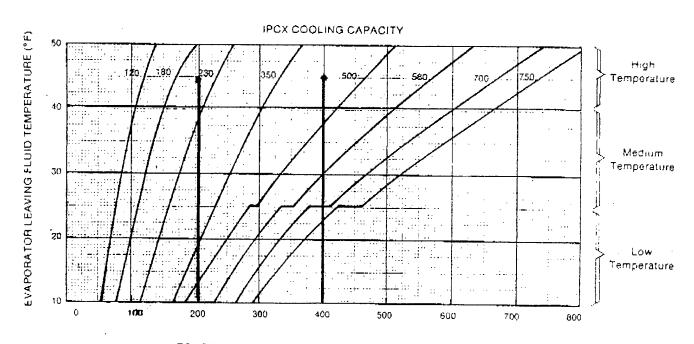
HORSEPOWER PER TON - Compressor horsepower per ton can be estimated from Figure 1 as a function of the cooled fluid leaving temperature and the condenser water leaving

temperature. As a rule of thumb, the curve values for horseower at design conditions can be reduced by 15 percent to estimate annual average electric consumption. This reduction results from operation at lower annual average condenser water temperatures resulting from annual average wet bulb temperatures lower than design.

PART LOAD PERFORMANCE - The curve on this page gives approximate percent power input as a function of the percent of full load tons and applies equally to all size units.







TONS AT 95° FLEAVING CONDENSER WATER TEMPERATURE

JOB	WINR	ESUS	STUDY	#1110-000

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_____ DATE 11-04-92

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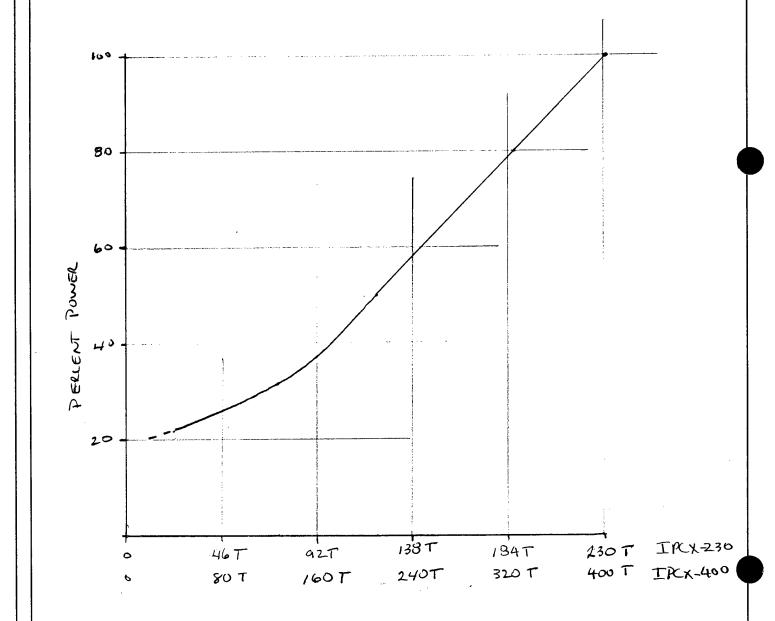
CALCULATED BY ______

DATE

ALT #3 POST. SCLEW COMA PERF CURVE

SOURCE: BUNHAM BUSH (FLY EQUIPMENT CO., DENVOR)

400TON/320 HP 230TON/158 HP



JOB UKMRESOS	STUDY #1110-000
SHEET NO.	3 _ of
CALCULATED BY	F DATE 11-04-92
CHECKED BY	DATE

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TECH AREA ALT #3

SURFACE CONDENSER SIZING.

REJECTED HEAT CALCULATION: O# STEAM MUST BE CONTENSED (980 BTU/R)

PLANT COOLING LOAD (TOIS)	FLOW PLATE (LB/HR)	(MB+W/M) (TONS)
,00	5970	5.85 / 487.5
200	6,281	6.16 / 513.3
300	11,245	11.02 / 9/8.3
400	10,307	10,10 / 841.7
500	17,767	17.41 / 1451,8 - MAX HEAT REVECTION.
600	14,588	16.26 / 1355.0

SIZE SURFACE CONDENSER AT 16,26 MBTU/HIL

SIZE COOKING DOWER!

HEAT OF REJECTION FROM CHILLERS = 600 TOWS X (1+ LOP)

= 600 X 112 = 720 TOWS

SURFACE CONSER HEAT OF REJECTION = 1355 TOWS

TOTAL TOWER LOAD = 2075 TOWS

F
U

FRY EQUIPMENT CO., INC.

2600 W. 2ND AVENUE SUITE 7 DENVER, COLORADO 80219 PHONE 303-922-8442 FAX: (303) 922-8445

DATE: _____ 3 APRIL 92

TRANSMITTED TO: ____ EMC

ATTENTION: CHET BUTLER | FROM: _____ LOW COLUMNS

SUBJECT: ____ WHITE SANDS MISSILE RANGE

This Transmission Consists of _____ Pages Including This Page.

BUDIET PALCING FOR STEAM TURBINES / THOUSTRIAL CHILL

MITH FRAME TO ACCEPT TURBINE, 158 H.P.

375 TON CHILLER, DUNHAM - BUSH # TPCX - 375 # 121,000 WITH FRAME TO ACCEPT TURBINE, 375H.P

550 TON CHILLER, DUNHAM - BUSH # TRXX - 580 # 158,000 WITH FRAME TO ACCEPT TURBINE, 495H.P.

B 158 H.P STEAM TURBINE, COPPUS # RLHA-19 23,000

375 H.P STEAM TURBINE, COPPUS # RLHA-24 # 28,500

550 H.P STEAM TURBINE, COPPUS # RLHA-28 # 32,000

TURBLUES WERE SELECTED ON 125 PETG INVET, 30 PSIG DUT 158 H.P. TURBLUE - 68:4 | bs/HR/HP - 10,814 | bs/HR 375 H.P. TURBLUE - 64 | bs/HR/HP - 24,000 | bs/HR 550 H.P. TURBLUE - 55:4 | bs/HR/HP - 27,436 | bs/HR



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2600 W. 2ND AVENUE SUITE 7 DENVER, COLORADO 80219 PHONE 303-922-8442

FAX: (303) 922-8445

DATE: 9 NOU 92	
TRANSMITTED TO:EUC_	
ATTENTION: Chet Butter FROM:	how Grands
•	oumps - White SANDS
	Including This Page.

chet:

two variations on Cooling Towers/pumps.

Depending upon how you determe" TOTAL heat rejections" Soon the chillers, as follows:

A. Consewative method, 2717 GPM, ADDED HEAT OF Congression

CELLS, 2717 GPM, 92°F - 80°F, 68°FWE GO H.P. Price: \$ 44,000

pumps, condenser water - DUNHAM-BUSH, THREE @ 906 GPM/EACH, 65' HEA # 20 HP-4 BAC-9", # 1900 each x 3=#5700=

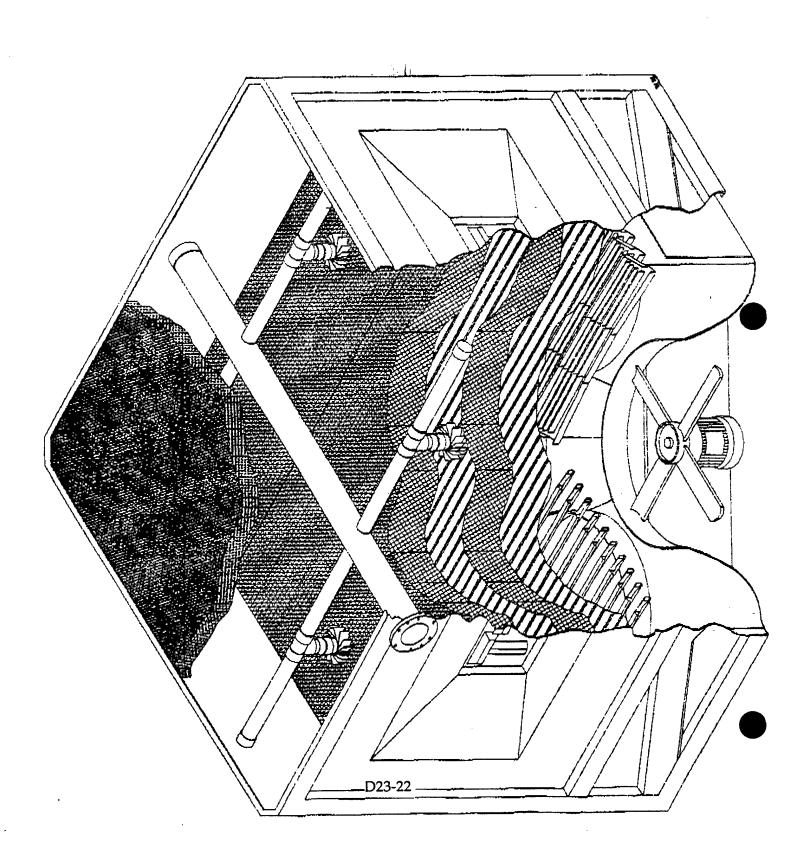
B. LEAST COSTLY METITOD, ASSUMING HIGH EFFICIENCY DUNHAM-BUSH CHILLERS 0.6 to 0.8 HP/TON, BO°F Condenses water.

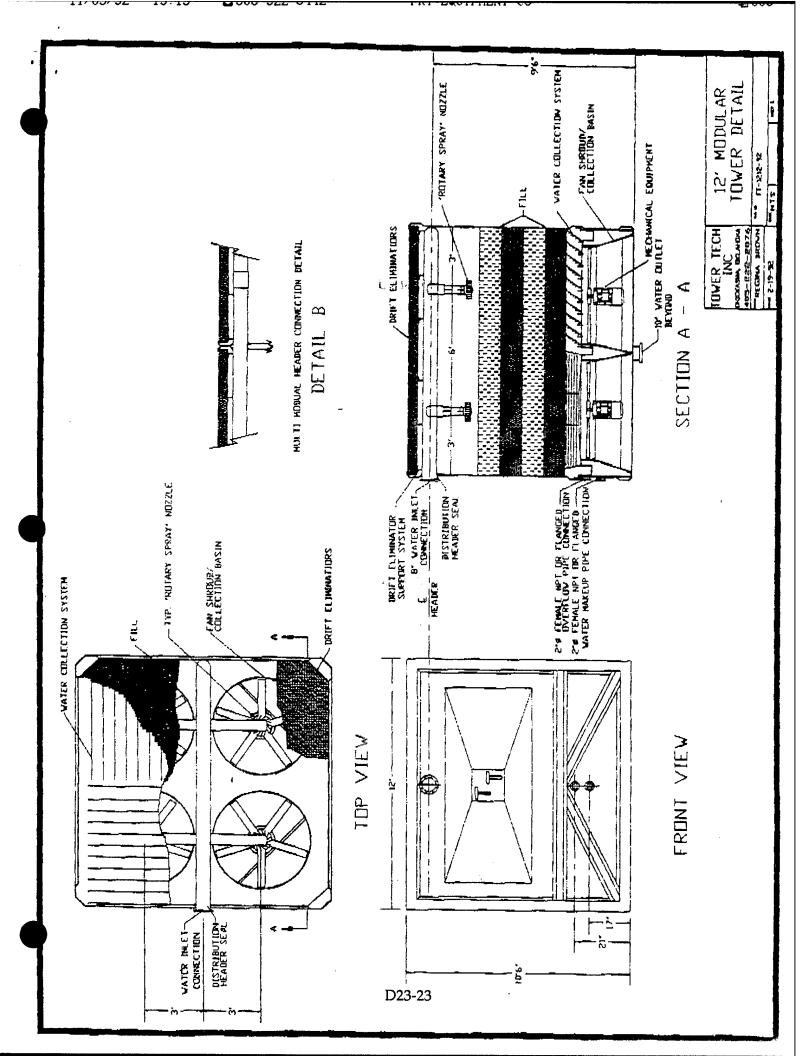
COOLING TOWER -> TOWER TECH # TTMT - 149-019, RTY-2 cells
1600 GPM, 92°F -> 80°F, 68°F WET BUCK, 32 HP FAN

DO2-21

Price: # 38,000

Conclosion water pumps - DUNHAM-BUSH, TWO @ 800 EPM each, G5'HEAD, model NO.





JOB WSMR ESOS	STUDY	#1110-000
SHEET NO.	/	of <u>2</u>
CALCULATED BY	CB	DATE 11-06-92
CHECKED BY	TF	DATE 4-09-92

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SURFACE CONDENSER PUMP:

1355 T. × 1074 BTU/16. × 11.2 16/Hr.T.R. = 16,300,000
BTUH.

 $\frac{69M}{500} = \frac{16,300,000}{500} = \frac{16,300,000}{6,000} = 2717$

PUMP HD

CONDENSER RD. 15'

PIPING RD. 20'

EVEV'N HD 30'

PUMP BHP = 2717 GPM × 65 HD × 1.0 SP 50. = 49.55

MOTOR HP = $\frac{\rho u M \rho BH \rho}{MOTOR EFF} = \frac{49.55}{6.9} = 55$

KW INPUT = PUMP BAP × 0.7457 = 49.55 × 0.7457 = 41.1 KW

MOTOR EFF. 0.90

USE 60 HP MOTOR. TO AVOID PUMP O'LOAD IF HEAD GOESTOO!

JOB	
SHEET NO.	~Z _{OF} _Z
CALCULATED BY	CB DATE 11-06-92
CHECKED BA	TE DATE 11-00-92

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COND. PUMP FOR CHILLER:

CHILLER 512E 720 T.R.

@ 3gpm/T.R. = 720 x3 = 2250 gpm.

Pump BHP = 2250 gpm × 70'141 × 1 sp.gr. = 44.2 3960 × 0.90 eff.

MOTOR HP = $\frac{Pump BHP}{MOTOR EFF} = \frac{44.2}{0.90} = 49$

KW INPUT = PUMP BHP x 0.7457 /MOTORETT. = 44.2 x0.7457

** PUMP HP = 36.7 KM.

CHILLER P.D. = 20'
Piping P.D = 20'
Elevin Hd = 30'
70'

USE 60 HP TO PREVENT O'LOADING MOTOR IF HEAD GOES TO O'

Ø 001

પ્રદેશના કેર્યા

SANS COLORS



09:49

FRY EQUIPMENT CO., INC. 2600 W. 2ND AVENUE SUITE 7 DENVER, COLORADO 80219 PHONE 303-922-8442

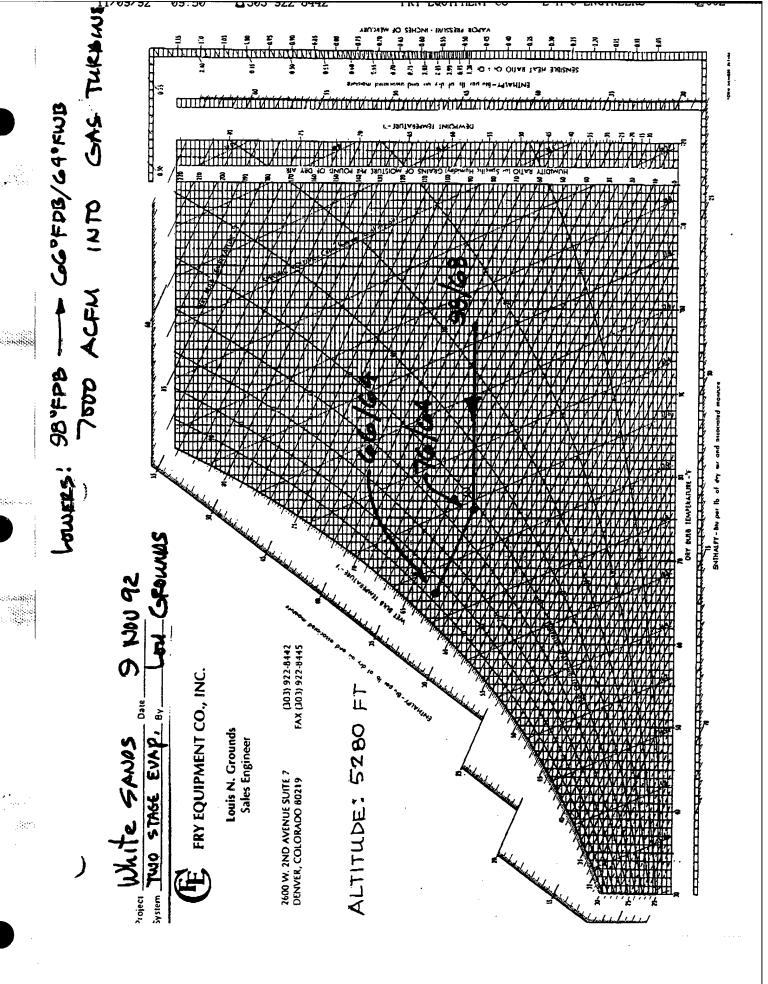
FAX: (303) 922-8445

DATE: S Nov 92
TRANSMITTED TO: EHC
ATTENTION: TOM FORSTER FROM: LOW GROWINGS
50202011
This Transmission Consists of Pages Including This Page.

TWO-STAGE EUAPORATIVE COLER WITH MIST ELIMINATORS TO COOL THE INLET AIR AND ADD MOISTURE FOR THE GAS TURBIN

7000 ACFM AIR FLOW, Engineered Commerced Concepts Inc model # INTPS-13, Copacity to reduce 98°FBB/68°FWB TO 66°FPB/64°FV with two-2HP Indust air stream scavenger four ord one 5 H.P. primary air supply four MIST Elementer will pass a maximum of 0.002: percent of displets at a maximum size 61 micr BURJET pure: \$ 17,200°

EVAP COOLER FOR GAS TURBINE INCET



	JOB UKMR 555 STUDY #1110-000
	SHEET NO
E M C ENGINEERS, INC.	CALCULATED BY TR DATE 11-04-92
Denver • Colorado Springs • Atlanta • Germany	CHECKED BY DATE
TECH AREA ALT #3	SCALE
SURFACE CONDENSER SIZING	G
REJECTED HEAT CALCULAT	
LOAD RATE	ENSATION
(TONS) (LB)HR) (MB	stake, (TONS)
	5 / 487.5
200 6,281 6,1	16/,513.3
300 1/245 11,6	52 / 9/8.3
400 10307 10.1	0 / 841.7
500 17,767 17.	41 / 1451,8
600 11,588 16.	26/1355.0
SIZE SURFACE CONDENSEL A	T 16,26 MBT4/HR_
SIZE COOLING DOWER!	
	CHILLERS = ,600 TONS × (1+ LOP)
hear of the second place	= 600 X 1,2 = 720 TONS
SURF, WNDENSER HEAT	
T	OTAL TOWER LOAD = 2015 TOWS.
517E COOU-6 70	WER @ 2100 TONS

E
E
E

ON PEAK - GAS TURBING GENERATOR W/ HRSG.

AUX. BUILER OR DUCT BURNER ON HRSG

STM TURBINE-DRIVEN ROT, SCREW

COMPRESSOR CHILLERS.

365d XION/d = 3,650 M/year.

OFF PEAK - 200 TON CENT. CHILLER (ELEC.DRIVEN)

AUX BOILER FOR TIA. STEAM LOAD

365d XI4h/d = 5110 M/yr.

E M C ENGINEERS, INC. Denver • Colorado Springs • Atlanta • West Germany

JOB	
SHEET NO.	OF
CALCULATED BY	DATE
CHECKED BY	DATE

HRSG : 4000 LB/AR @ 125#

1991 Mems: p/51 MAT'L Labor TVT OHIP TOT
1152440: \$23,050 5,575 28,625 5,075 \$33,700

EXCREME TO 1993: (0 5%). $(1.05)^{2} = 1.1025$ $33,700 \times 1.1025 = {}^{3}37,200 \times {}^{3}37,000$

H RS6: 7100 LB/HR (125# (ESTIMATED PRICES)

#56,800 12,000 68,800 12,200 #7,000

ES(KLATE! (1.05) = 1.1025 1.1025 x \$1,000=

JOB WSMRESUS STUDY #1110-000

SHEET NO. . TF DATE 11-06-52

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

CALCULATED BY ____ __ DATE 11-12-92 CHECKED BY ____

ALT #3 DERF, SUMMARY (500 KW GEN. SET

> ON PEAK OFF PEAK TOTAL

Elec. (KWh) DEMAND (KW) GAS. (MBTU)

(5,511) (7,110)

332,150 (909,916) (577,766)

(58,241)

AVOIDED ELEC(KWL)

1,41,300

SCALE .

1,4,11,300

DEMAND (KW)

4,930

4,980

AVOIDED GAS

7,905

7,905

T OT. ELEC. SAVINGS (KWh)yn)

B33, 534

TOT. KNN. DEMAND (KW) SHINKS

6,072

TOT. ANN GAS SUGS (MBTH)

(50,716)

CONSTR WIT ~ # 4,364,499

SIR= -.18

SPB = - 155 YRS

JOB WSMR ESOS STUDY #1110-000

CALCULATED BY ______ DATE 11-06-92

SCA

E M C ENGINEERS, INC.

Denver • Colorado Springs • Atlanta • West Germany

ALT #3 ON PEAK ANALYSIS

500 KW GASTURBINE GENERATOR SET (422 KW DERATED)
HRSG W/ 4000 LB/HR OF 125 PSIG STEAM
AUX. BOILER - 11,000 LB/HR OF 125 PSIG STEAM

	JAN	FEB	MAR	APR	MAY	JUN
Hours/mo	3/0	290	3/0	300	3/0	300
TOWN (SNE)	36	47	104	217	417	500
CHILLER PART LUAD	•/ 9	-24	.52	1.08	-70	-83
CHILLERHA	38	45	76	162	326	378
Tucsine Stm Flow (LB/HR)	1,700	1,900	2,900	6,400	10,500	12,700
TECH AREA STM FLOW (LB/HR)	676	540	345	345	345	345
TOT, STM LUKO (LB/HP)	2,376	2,440	3,245	6,745	10,845	13045
HRS6 STM PRODUCTION (LB/HR)	2,376	2,440	3,245	4,000	4,000	4,000
CLB/HR)	0	Ð	O	2,745	6,845	9,045
GAS TURB * FUEL (MBTU/HR)	7.458	7.458	7,458	7.458	7.458	7,458
BUILER FUEL (MBTH/HP)	0	O	b	4.37	10.884	14.383
GAR PURCHASE (MBTU/MO)	2,312	2,088	2,312	3,547	5,686	4,552
GENERATOR OUTPUT (KW)	422	422	422	422	422	422
(KM)	331	331	331	33)	331	331
NET KW	91	91	91	91	91	91
NET KWYMO	28,210	25,480	28,210	27,300	28,210	27,300

* 16,216 BTU/EW-42 422 KW X 1031 BTW/CF = 7.458 MBT9/HR

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ALT #3 ON PEAK ANALYSIS

JOB WSMR	ESOS STUDY	#1110-000
SHEET NO.		of <u>3</u>
SHEET NO.		
CALCULATED BY	<u> 7F</u>	DATE 11-06-92
CHECKED BY	95	DATE 11-12-92
OTICONED DT		
SCALE		

500 KW GASTURBINE GENERATOR SET HRSG W/ 4000 LB/HR OF 125 PSIG STEAM AUX. BOILER - 11,000 LB/HR OF 125 PSIG STEAM

	JUL	AUG	SEP	OCT	NOV	pec
Hours/mo	310	310	300	310	300	3/0
TONS) AVE	514	500	427	231	83	48
CHILLER PART LUAD	.86	.83	.71	.58	٠4٤	.24
CHILLER HP	412	407	309	172	55	45
tursine stm Flow(LB/HR)	14,400	13,900	11,700	5,900	2,950	1,900
tech area stm flow (lb/H2)	345	345	345	345	345	444
LUHO (LB/HP)	14,745	14,245	12,045	6,245	3,395	2,344
HRS6 STM PRODUCTION (LB/HR)	4,000	4,000	4,000	4,000	3,395	2,344
(LB/HR)	10,745	10,245	8,045	2,245	· 0	0
GAS TURB FUEL (MBTU/HR)	7,458	7,458	7.458	7.488	7.458	7.458
BUILEL FUEL (MBTH/HP)	17.086	16.291	12,793	3.570	-0	O
GAS PUPCHASE (MBTU/MO)	7,609	7,362	4,075	3,419	2,237	2,312
GENERATOR (KM)	422	422	42	422	422	422
PLMT ELEC	331	331	331	331	331	331
NET KW	91	91	91	91	91	91
NET KWYMO	28,210	28,210	27,300	28,210	27,300	28,210

	JOB WSMR	- EEOR ZINDA	#1110-000
	SHEET NO.		OF 3
E M C ENGINEERS, INC.			DATE 11-06-92
Denver • Colorado Springs • Atlanta • West Germany	CALCULATED BY	is	DATE 11-12-92
ALT 3 DERFORMANCE SUMMA	CYCHECKED BY		DATE
(275 VW (50 (5)	SCALE		

	ON DEALL	OFFREAK	TOTAL
ELEC (KWh)	1,299,400	(909,916)	389,484
DEMAND (KW)	4,272	<u> </u>	4272
GAS (MBTM)	(57,857)	(7,110)	(64,967)
AVOIDED ELECKUM	1,411,300		1,411,300
NOIDED DEMAND (Kh	1) 4,980		4,980
AVOIDED GAS (MBTY)		7,905
TOTAL ANN. ELE SAVINAS (ILW	(h)		1,800,784
TOT. DEMAND REDUCTION (KIN	u) -		9,252
TOT ANN GAS SAVINGS (MBTY)	***************************************	(57062)
CONSTAL COST	<u>~</u> \$ 4,813,7	33	

31R = 0.015PB = 142

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ALT #3 ON PEAK ANALYSIS

JOB WSHR	ESOS STUDY	#1110-000
SHEET NO	2	DF
CALCULATED BY	TF.	DATE 11-06-92
CHECKED BY	J2 ,	DATE 11-12-92
SCALE		

875 KW GASTURBINE GENERATOR SET (750 KW DERATED) HRSG W/ 7,109 LB/HR OF 125 PSIG STEAM AUX. BOILER: 7,700 LB/HR OF 125 PSig STEAM

	JAN	FEB	MAR	APR	MAY	JUN
Hours/mo	3/0	280	3/0	300	310	300
LOAD (TONS)	36	47	104	217	417	200
CHILLER PART LUAD	-18	.24	.52	1.08	.70	-83
CHILLER HP	38	45	76	162	326	378
TURSINE STM FLOW (LB/HR)	1,700	1,900	2,960	6,400	10,500	12,700
TECH AREA STM FLOW (LB/H2)	472,6	397.9	345	345	345	345
TOT. STM LUKO (LB/HR)	2,173	2,298	3,245	6,745	10,845	13,045
HRS6 STM PRODUCTION (LB/HR)	2,/73	2,298	3,245	6745	7,109	7,109
AMY BOILEL (LB/HR)	U	O	٥	ပ	3,736	5,936
GAS TORB * FUEL (MBTU/HR)	11.43	11.93	11.93	IL. 9 3	11.93	11.93
BUILER FREL (MBTH/HR)	Q	O	0	O	5,94	9,44
GAR PURCHASE (MBTU/MO)	3,698.	3,340	3,698	3,579	5,540	6,411
outhat (KM)	750	750	920	750	750	7570
(KM) SIMIECEC	356	356	356	356	356	356
NET KW	394	394	394	394	394	394
NET KWYNO	122,140	110,320	122/40	118,200 BTU/E	122,140	118,200

+ 14,594 BTU/KW-HE X 750 KW X103) BTU/CF - 4.93 MBTU

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ALT #3 ON PEAK ANALYSIS

JOB WSMR	ESOS STUDY	#1110-000
SHEET NO	3	of <u>3</u>
CALCULATED BY	TF	DATE 11-06-92
CHECKED BY	95	DATE 11-12-92
2215		

875 KW GASTURBINE GENERATOR SET (750 KW DERATED)
HRSG W/ 17,109 LB/HR OF 125 PSIG STEAM
AUX. BOILER: 7,700 LB/HR OF 125 PSIG STEAM

	Jul	AU6	SEP	OCT	Nov	DEC
Hours/mo	3/0	3/0	300	310	300	310
AVE, COOUNG LOAD (TOUS)	514	500	427	2.31	83	48
CHILLER PART LUAD	- 86	.83	-71	-58	-42	.24
CHILLER HP	412	407	339	172	55	45
TURSINE STM FLOW (LB/HR)	14,400	13,900	11,700	,5,900	2,950	1,900
TECH AREA STM FLOW (LB/H2)	345	342	345	345	345	356,5
TOT. STM WHO (LB/HR)	14,745	14,245	12,045	6,245	3,295	2,257
HRS6 STM PRODUCTION (LB/HR)	7,109	7,109	7,109	6,245	3,295	2,257
ANX BOILEL (LB/HR)	7,636	7,136	4,946	- 0	1,0	0
GAS TURB FUEL (MBTU/HR)	11.93	11.93	11.93	11.93	11.93	11.93
BUILER FUEL (MBTH/HP)	12-14	11.35	7.86	0	-0	9
GAS PURCHASE (MBTU/MO)	7,462	7,217	5,937	3,698	3,579	3,698
outhat (KM)	750	750	750	750	750	750
PLANT ELEC	356	356	356	356	356	356
NET KW	394	394	394	394	394	394
NET KWYNO	122,140	122,140	118,200	122,140	118,200	122,140

JOB WSMR ESOS STUBY #1110-600

CALCULATED BY TF DATE 11-06-92

E M C ENGINEERS, INC.

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ALT #3 OFF PEAK WALYSIS

	WAT	FEB	NAR	APR	MAY	<u> </u>
HOURS/MO	434	392	434	420	434	
ALVE. COOLHS LOAD (TOMS)	15	18	28	48	704	
PART LUAD	.08	.09	.14	•24	-52	
CHILLER KW	1.59	1,42	0.96	0.70	0.55	
DRIVE (KM)	24	25.5	27	34	57	
PLANTAUX ELEC (KW)	115	115	115	115	115	
TOT, PLANT ELEC (KW)	139	140.5	142	149	172	
FLER (KWH/MO)	60,326	55,076	61,628	62,50	74,648	
TECH AREA STM LUAD (LB/HR)	4,430	1,915	1,192	83	83	
BUILER @0.75 FUEL @0.75 MBTU/HR eff	7,044	3.045	1.895	0.132	0.132	ududu Masa sumayan gar
GAS PURCHASED MGTH/MO	3,057	1,194	822.6	55.4	55,4	
FLEC KWH						

BOILER FUEL = [X (B) X 1192.6 BT4 0.75] X10-6 MBTU

JOB WSMR ESOS	STUBY #1110-600
SHEET NO.	2 of 3
CALCULATED BY	TT 11 01 0
CHECKED BY	

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ALT #3 OFF PEAK AWALYSIS

	JUN	JUL	Aug	SEP	OCT	
HOULS/MO	420	434	434	420	434	
AME. COOLING (TOMS)	204	229	198	83	42	
PART LUAD	1.02	1.145	0.99	.42	.21	
CHILLER KW	0.59	0.55	0,60	0.56	-76	
DRIVE (KM)	121	127	119	46	32	
ELEC (KW)	133	133	133	133	133	
TOT, PLANT ELEC (KW)	254	260	252	179	165	
TOT PLANT ELEX (KWHMO)	104680	112,840	109,368	75,180	71,610	
TECH AREA STR LUAD (LB/HR)	83	83	83	8-3	120	
BUILER FUEL MBTU/HR	0,132	0./32	0,132	0.132	0.191	
PURCHASED MBTH/MO.	55.4	55.4	55.V	55.4	818	
FLECKWH PURCHASEN/NO						
		1	I	ţ	1	ŧ

JOB WSMR ESOS	STUBY #1110-600
SHEET NO.	3 of 3
CALCULATED BY	TF DATE 11-06-92
CHECKED BY	DATE

Denver • Atlanta • Germany

ALT #3 OFF PEAK AWALYSIS

	1		ANNUAL
•	NOV	DEC	Tairr
HOULS/MO	420	434	
LUAD (TONS)	25	16	
PART LUAD	-13	.08	
CHILLER KW	1.64	1.56	
SUIVE (KM)	26	25	
PLANTAUX	115	115	
TOT, PLANT ELEC (KW)	141	140	
FLER (KWH/MO)	59,220	60,760	909,916
TECH AREA STM LUAD (LB/HR)	520	1,846	
BUILER FREL MBTU/HR	0.827	2,935	
GAS PURCHASED MOTH/MO.	347.3	1,274	7,110
FLEC KWH		-	909,916

E M C ENGINEERS, INC. Denver • Colorado Springs • Atlanta • Germany

JOB WS MR	ES US STUDY	#1110-000
SHEET NO.		OF <u></u>
CALCULATED BY	C.B.	DATE
CHECKED BY	TF	DATE 3/31/92
SCALE		

STL CARRIER PIPE W/2 MIN. WOOL INSULATION IN STEEL CONDUIT & CATHODIC PROTECTIVE.

CARRIER PIPE - (IN TRENCH W/ 4/ MIN BACKFILL.)

512E	LENGTH	\$/LF	TOTAL
10"	84 LF	156.0	13,104
8"	570 UF	131.62	75,023
611	1735	111.57	193574
5"	1149	102-	117,198
4"	980	93-	. 91,140
3"	1,076	84	90,384
2/2	269	78	20,982
2	284	74	21,016
	6,147		#622,421

STL CARRIER PIPE SAME AS ABOVE EXCEPT SCH. 80.W/1"MIN. WOOL.

5120	LENGTH	\$/LF	TOTAL
3",	84	74	6,216
2-1/2"	910LF	69-	62,790
2 4	25-44 LF	65	165,360
1-1/2"	1971 LF	61-	120,231
1-1/4"	488 LF	59	28,792
1 "	150 LF	56	8 400
	6147		# 391,789

MANHOLES (INCL EXPANSION JOINTS, ISOLATION VALVES, TRAPS, ANCHORS, VAULT.)

PIPE SIZE	979	PRICE EA.	TOTAL.
8"	3	11,070	33,210
6"	8	9051	72,408
5"	3	8800	26,400
4"	3	8200	24,600
			#156,618

TOTAL STEAM & CONDENSATE PIPING; \$ 1,170,828

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JOB	
SHEET NO.	2 of 6
CALCULATED BY CB/AN	DATE 2-31-92
CHECKED BY	DATE

BLOG.	PEAK HEATING	STEAM
No.	LOAD (KBTUH)	USAGE (16/Hr.)
1504	1,087.4	1171
1506	2,5500	2745
1510	1,491.2	1605
1512	Z840.0	3057
1526	1,268.7	1366
1528	297.5	320
1530	1,341.4	1,444
1534	1,003.0	1,080
1538	1,042.8	1, 123
1540	762.9	821
1544	1,130.5	1,217
1550	785,3	845
1554	792. 8	853
1558	564.1	607
1621	1,632.0	1,757
1622	1, 422.9	1,532
1623	310.0	334
1624	1,631.3	1,756
1644	778.1	838
1646	767.7	826
1648	559.9	603
1649	301.2	324
1650	306.6	330
1676	534.6	575
11678	1130.9	/217
1680	755.1	8/3
1690	222,2	239 D23-41

JOB WSMR	E203	STUDY	*	±11/0-000	
SHEET NO.		3	OF 6	2	
CALCULATED BY	A. Nien	neyer	_ DATE _	4-2-92	

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COST ESTIMATE FOR

CONDENSATE RETURN SYSTEM PUMPS & SCALE
HEATING SYSTEM CONVERSIONS. (Overhead & Profit not included)

	1	1	(11 0 150)	
BLOG.	CONDENSATE RETURN SYST.	STEAM TO H.W.	(NO BOILER) HEATING SYSTEMS JOY	TOTAL COT
No.	RETURN SYST.	HEAT EXCHANGER(\$)	(Hydronic W/ Unit Healers) #)	PER BLOGE
15-04	3,430	1,000	·	4,430
1506	3,430			4,436
1510	3,430			4,436
1526	3, <i>43</i> 0			4,430
4/5-38	3,430		73, <i>0</i> 00	77,430
1621	3,430			4,430
1623	3,430			4,430
1624	3,430			4,430
×1646	3,430		53,740	38170
¥1648	3,430		39, 194	43,624
1649	3,430			4,430
¥1650	3,430		21,459	25,889
1676	3,430			4,430
1678	3,430			4,430
1680	3,430			4,430
¥1690	3,430	\	15,557	19,987
	54,880	16,000	202,950	273,830

CHECKED BY

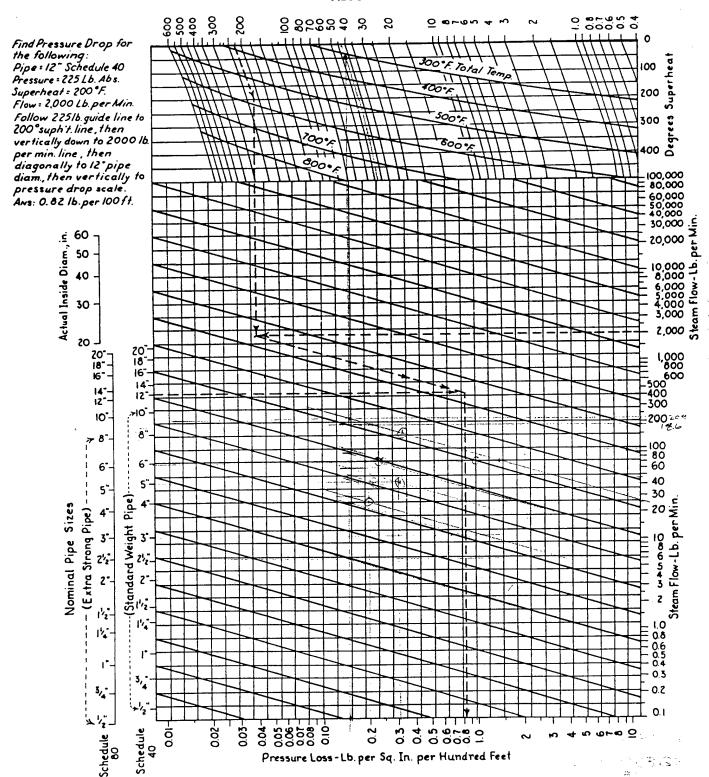
* BLOGS W/ FORCED AIR N.G. HEATERS

** \$289/Mat, & Lab. Cost (No Overthead & Profit)

Graphical Solution of UNWIN's Formula

4 OF 6

ABSOLUTE PRESSURES



6 OF 6 E M C ENGINEERS, INC. __ DATE . Denver • Colorado Springs • Atlanta • Germany INSULATED PIPE 192: IN CONDULT (SCH40) 180 168 156 144 132 #/_F 120 108 96 84 72 60 48 36 24 12

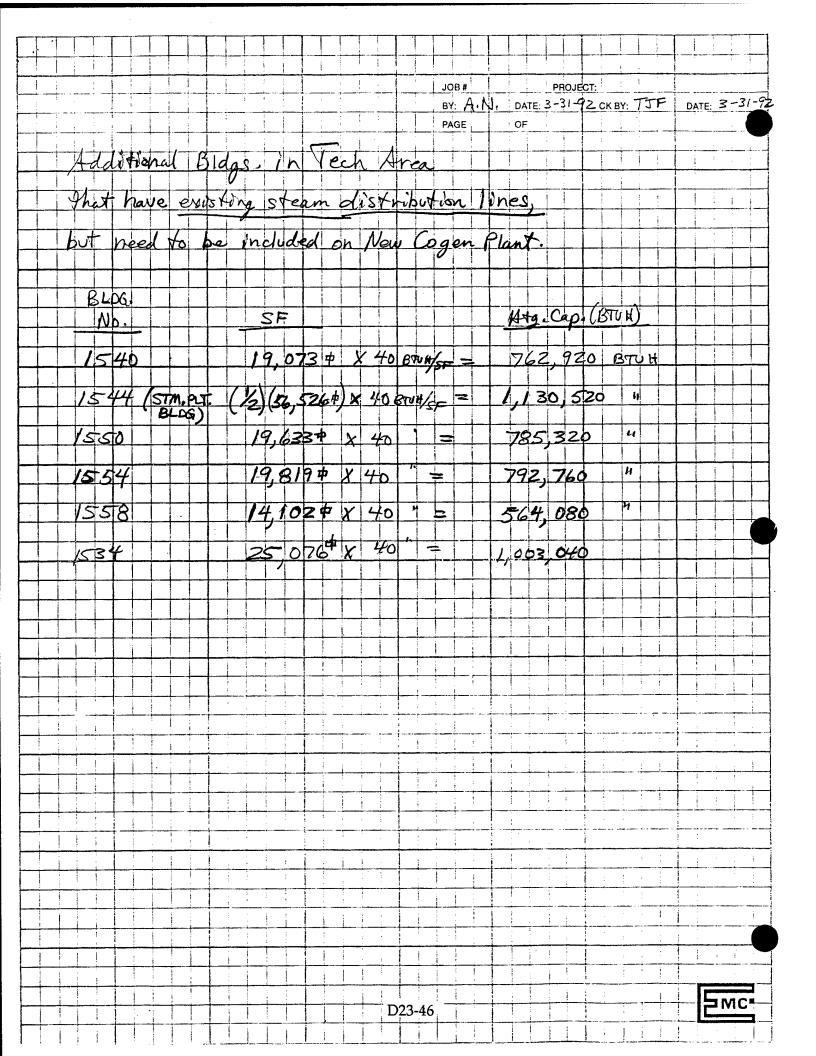
D23-44

PIPE SIZE (Nom - IN.)

JOB _

			TECH AREA	+		
		EXISTING BOILER	DESIGN LO	AD.	EST.	131 141
)	βιρG. No:	CAP. (BTUH)	TRACE ANAL		Process &	Peak Hert Land (BTUH)
			(for Hig) (B'	(HOT	Misc. Loads.	(use to size
	STM PLT	3 at		-	(BTUH)	Steam lires)
	BLOG. 1544	5,808,000 (NG.)				
	· · · · ·	_ E. & W. ZONES				
	1506	2,625,000 STM	739, 79	0_	280,000	2,550,000
	w. All	Him 780,000 HW				· · ·
	1512	3,680,000-STM-	280,70	4	500,000	
	1526	2,200,000 HW	645,80) <u>Q</u>	200,000	1,268,700
				0		
	1528 s	TM from BLOG.	222,5	06	375 005?	
		1544	•			
		TM from BLOG.	1,341,4	3.3		
		रिसर				
	1621	1,632,000 HW	259,06	8	100,000	1,632,000
		10 10 10 10 10 10 10 10 10 10 10 10 10 1	The state of the s			
,	1622 3	318, 250 STM	698,62	23	250,000	1,422,900
					-3	
	1623	310,000_HW	247, 986			<u>3/0/000</u>
			<u> </u>			
	1624	2175,000 HW_	685,107		500,000	
				<u>l</u>		
	17.00	1011 53 H 81	Tuth and a By	-		- 1 AV 2 OV 2 A- 11
-	1644	19453 \$ x 40 83	18,120 Up	_/_	538 26,0	171 \$ x 40 = 1,042,840 BTH
	1/ ///	10 10= A V/1 874	# 717722 BTOU			ad V 44 = 2 = 200 00001
	1646	19,193 \$ X40 872	F= 161,120 "	/6	,49 753	04 X 40 = 301, 200 BTUH
	1/ 140	13,998 \$ x 40 875	- FEG 970 BTW.	 12	Th 7/11	4 \$ X 40 = 306,560 BTUH
	16.48	13, 790 1 1 70 751	351,120 4	16	50 7664	306,360 PION
	1171	13,364 \$ X 40 8TU	== 534 560 8704	15	04 27,18	35 4 ×40 = 1,087,400 BTOH
	1676	13,361 +11 10 31	r 3- 1,300 n	<u> </u>		A CO THE POST TO BEEN
	1678	28,272 \$ x40 =	1,139880 8704	15	7/0 3,72	8 \$ X40 = 149,120 BTUH
	17.00	1000774W. = 1	70-00-0-11		<u></u>	· ·
	1680	18,877 + X40 =	122,080 BIUN			: 1
	11.04	seconth and	שותם אוים בסם		1 - 4-10 pm # 1 - 1	
	1690	5556 \$ X40 =	222, 270 BION			
				1		

8555666



LIFE CYCLE COST ANALYSIS SUMMARY **ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

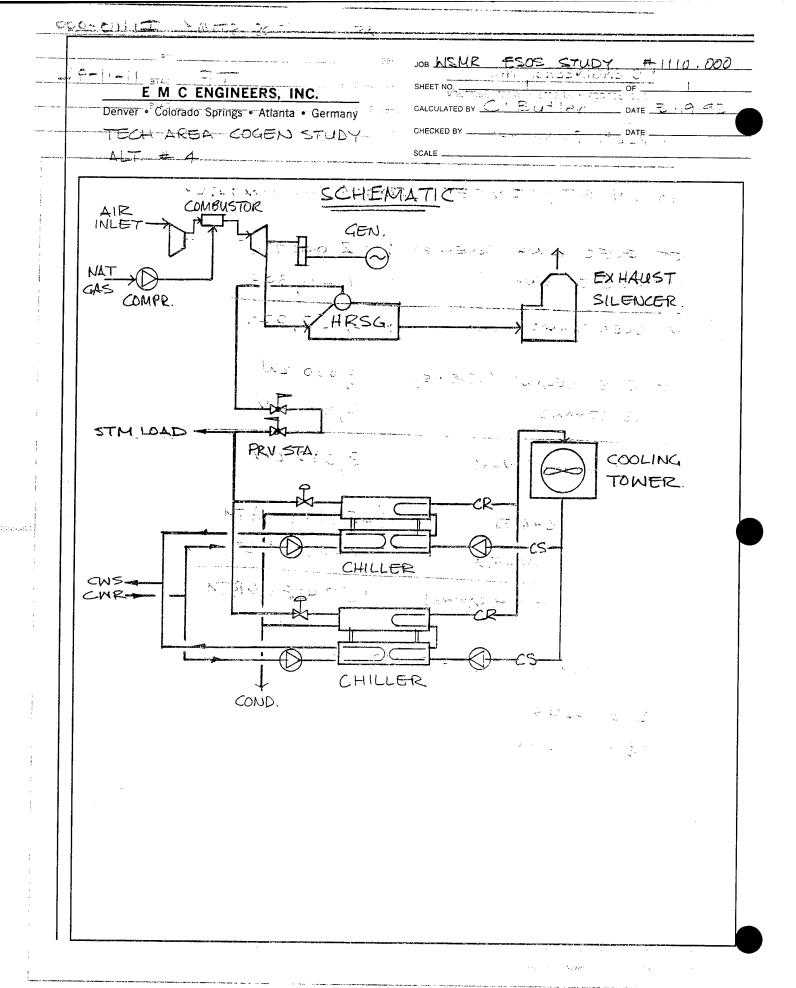
		LOCATION: WE	ita Canda Missila	Banas	DECION.			
		LOCATION: Whi		-	REGION:	4	PROJECT NO:	DACA 63-91-C-0152
				HILLER PLANT (ALT 4)			FISCAL YEAR:	1992
		ANALYSIS DATE:		TOTAL	500NON40 155			
		ANALYSIS DATE:	11/11/92		ECONOMIC LIFE:	25	PREPARED BY:	T. FORSTER
1	INV	VESTMENT						
•		CONSTRUCTION	COST				\$4 500 104	
		SIOH COST	0001	(5.5% of 1A) =			\$4,592,134	
		DESIGN COST		(8.0% of 1A) =			\$252,587	
	D.			•			\$275,528	
		SALVAGE VALUE		(1A + 1B + 1C) =			\$5,120,229	
		TOTAL INVESTM		(1D - 1E) =			\$0	\$5 100 000
	• •	TOTAL IIIVESTIMI	_141	(10 - 12) =			>	\$5,120,229
2	EN	IERGY SAVINGS (+) / COST (-)					
		FUEL TYPE	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	
			\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	
	A.	ELEC	\$6.48	11,782	\$76,287	15.23	\$1,161,848	
	В.	DIST		0	\$0	17.28	\$0	
	C.	NAT GAS	\$2.21	(57,428)	(\$127,054)		(\$2,495,335)	
	D.	PAPER		0	\$0		\$0	
	E.	COAL			\$0	16.22	\$0	
	F.	TOTAL		(45,646)	(50,766.9)		>	(\$1,333,487)
3	NO	N-ENERGY SAVIN	IGS (+) / COST (~)				
	A.	ANNUAL RECUR	RING (+/-) (ELEC	. DEMAND SAVINGS +	-		\$55,587	
		MAINTENANCE C	OST SAVINGS)					
		1 DISCOUNT FAC	CTOR		(From Table A-2) =	14.68		
		2 DISCOUNTED S	SAVINGS (+) / CO	ST (-)	(3A x 3A1) =		\$816,017	
	В.	NON-RECURRING	G (+/-)					
		ITEM			YEAR OF	DISCOUNT	DISCOUNTED	
				SAVINGS (1)	OCCURRENCE (2)	FACTOR (3)	SAVINGS (4)	
		a. EQUIP REPLAC	CEMENT COST	\$100,000	1	0.96	\$96,000	
		b. EQUIP REPLACE		\$193,500	5	0.80	\$154,800	
		c. EQUIP REPLAC	CEMENT COST	\$ 713,250	10	0.64	\$456,48 0	
		d TOTAL		\$1,006,750	•		\$707,280	
				ED SAVINGS (+) / COS	T (-)	(3A2 + 3Bd4) =		\$1,523,297
	D.	PROJECT NON-E	NERGY TEST					
		1 25% MAXIMUM	NON-ENERGY	CALCULATION		(2F5 x 0.33) =	(\$440,051)	
		a IF 3D1 => 3C						
			HEN CALCULAT	ESIR		(2F5 + 3D1) / 1F =	-0.35	
		c IF 3D1b => 1						,
		d IF 3D1b < 1 TI	HEN PROJECT D	OES NOT QUALIFY				
4	FIF	RST YEAR DOLLAR	SAVINGS (+) / C	OSTS (-)	(953	+ 3A + (3B1d/25)) =		\$4E 000
		TAL NET DISCOUN		🗸 🗸	(2. 5	(2F5 + 3C) =		\$45,090 \$189,810
		SCOUNTED SAVING		MENT RATIO (SIR)		(5/1F) =		0.04
		F SIR < 1 THEN PR				(3.11) =		0.04
7		MPLE PAYBACK (SE		- · · · ,	,	(1F/4) =		114
		•	-			\		114

	CONCEDITORION COST ESTIMATE BEALESTINE	COLFACO.	74461							
altern talendar		BHEAND							and the second	
CONTRACTOR	EMC ENGINEERS INC.			ADDRESS 2750 SOU	TH WADSV	VORTH BLV	ADDRESS 2750 SOUTH WADSWORTH BLVD., #C-200, DENVER, CO	DENVER, C	0 80227	
CONTRACT	CONTRACT FOR (Work to be performed) TECH AREA (ALT 4)						PROPOSED TOTAL	PROPOSED TOTAL CONTRACT PRICE		- FC
PURCHASE F	PURCHASE REQUEST NUMBER			PROJECT NUMBER	G	0000	WORK LOCATION	IDS MISSILE	WORK LOCATION WHITE SANDS MISSILE RANGE, NEW MEXICO	W MEXICO
				MATERIAL COST	cost	,,	LABOR CUSTS.			
e L	ltem	Chit	Quantity			Manhours	Average		Other	9
၌	ξ	Measure (2)	@	Ę g	Total	Mandays	Rate	Total	Costs	Total
-	200 TON ABSORPTION CHILLER 400 TON ABSORPTION CHILLER	LUMP		323750	323750					\$323,750
7	1100 TON COOLING TOWER	EA	***	4944	49444					\$49,444
ဗ	PUMPS, VALVES, ETC.	WNS JWN1	-	229429	229429			trope grand		\$229,429
	1600 SQ.FT. BLDG.	ЗE	1600	30.00	48000			Y L		\$48,000
 D24-2	BURIED CWS & CWR PIPING	SUM	- <u> </u>	558700	5			- L		\$558,700
	VAULT W/EXP. JOINTS, VALVES, ANCHORS, ETC	EA	5	10800	54000		and the second			\$54,000
	INTERCONNECTION @ BLDG.	EA	6	14000	126000	v 1		- 3		\$126,000
. .	GAS TURBINE WITH 500 KW GENERATOR HRSG & AUX BOILER	LUMP SUM	_	422600	L	V 2.		. پ		\$422,600
6	GAS BOOSTER COMPRESSOR	EA	_	50000	20000			Ç*		\$50,000
01	CONNECTION TO BASE ELECTRICAL SYSTEM ELECTRIC SWITCH GEAR	E	-	92000	95000					\$95,000
Ξ	STEAM AND CONDENSATE PIPING SYSTEM	EA	1	1170828	1170828	, , (c)				\$1,170,828
12	BUILDING HEATING SYSTEM CONVERVSIONS	EA	1	273830	273830	and the second s				\$273,830
	SUBTOTAL					27.7 P		<i>i</i> '	Marie First	\$3,401,581
	OVERHEAD & PROFIT (25%) CONTINGENCY (10%)									\$850,395 \$340,158
	TOTAL THIS SHEET									\$4,592,134

SOURCE: Means Electrical and Mechanical Cost Data, 1992; Steward & Stevenson Services



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THE PRINT OF THE PROPERTY WINDOWS SHOWS A PROPERTY OF THE PROP	WSMR ESUS STUDY #1110-0
	SHEET NO OF
E M C ENGINEERS, INC. Denver • Colorado Springs • Atlanta • West Germany	© CALCULATED BY DATE DATE
Deriver - Colorado Springs - Atlanta - West Germany	The state of the s
LT #4 PERF. SUMMARY	SCALE SCALE
	A and A hand a second
500 KW GIT/GENSET D	The state of the s
	ALE - A TATU CON.
NET ELEC KWH (REVENUE)): 2,040,740
AVOID ES ELEC KWh	: 1,41,300 TAV
9530512 L	CAS COMPR.
TOT, ELEC SMINGS HIEWAY	1,023,45,2,020
• • • • • • • • • • • • • • • • • • •	
NET ELEC DEMAND (REVENUE)	3,080 KW
AUDIDED DEMAND	4,930 FW
700 10 C 2010 C	CAOL NITS
- 82 / S 6444	8,060 kW
TOT DEMAND SAMMS	
NOT KAS PURCHASED	(65, 533) MBTM
0.000.00	TG OS MBTU
AUDIDED GAS PURCHASE	SELU-0
N ET GASSAVINGS	(57,428) MBTU.
	The second secon
CONSTRUCTION COST & # 4	609.000
CONSTRUCTION WILL OF THE	
SIR = 0.04	CONO
SPB= 114 YR.	
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EM G	ENGINEERS, INC.				OF
Denver • Colorado	Springs • Atlanta • West Germany		ATED BY		
37.0	parties a commission and commission department of the commission o		D BY	t Carrier Pr	DATE
ALT #	4 Equipment Dus	A SCALE _		with the same	7331
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C17 •	16,216 BTU-10W	h 447		4-	g was the same
	Was all Asso				1 1
ENTE :	422 KW DERAM	-1) - E-OR	INLET	C023	
	5 ALTITUDE				
1450	£2. ÷3.	C 8.		<u> </u>	
1-1 1656	11 0000 1 1 1/10 10	17-	(16 575		
• '	4000 LB/HR OF HAZZL BTU/LB	ا کے ا		. / •	
	HAZIOBTU/LB	4 41.	he we go	my file is	
A 5	1511 50		i		
1 5.445 E	STOCK CONTRACTOR	0,625	(- D. T.)	(,5"	me _t
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	12.000 BTV V	./		= 11.46	1 LB/HR-TUN
15.	12,000 BTU X 11	x (115	9.8-206,1	ν	
	1	·		₹	
PLANT		w\A 3#	e	of g	Company (Company)
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	THEAM SE	KW		W. S. F. J. J.	
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	JOB WSMR ESUS STUDY # 1110-00=
©. 755nć	E Mo SENGINEERS INC. ON TBBHS
E M C ENGINEERS, INC. YE TETALUDUAN	Springs . Tiso . E. 1. 46 Bathlusses
Denver • Atlanta • Germany - ^{vs 6a-sa-c}	CHECKED BY DATE
ALT #4 PERFORMANCE	SCALE TO A GIVEN E LA TUA
LIZYJANA	

	7711					
	JANT	FEBUIL	-MARC-	~ APPL	MAYNO	AUN.
#2742/m D.	744	672	744 N.A	1720E	17441	720
LUADO (TONS)	23.8-	7-3041	الرور وو	一角色yW. ヨúvt.コ		327.3
CHILLER PART LOAD	-12	-15	.30	.64	-59	2251-1
(LB/HR-TON)	11.44	ा.५५ ॥.५५	11.44	11:44 i	1	°11.44
(HILL ET STEAM FLOW (LB/HR)	272.3	344.38.	483.0	1354.5 124.5	3727.5	3,744.3
HRS 6 STEAM PRIDUCTION (LB/HR)	¹2712-(3 15-7	3.44.3 920 00	7507	7,374.5	2968/15	द्गियं.3
FLAGUETION (LR/HR)	,	173 BL	1	i		1
BSILER FUEL (MBtu/ho)	0	0	0	· WAPT	OPHOTOLOGIC	٥
(MBtu/ms)	5,548.8	5,011.8	5,548.8		5548.8	5,369.8
PLANT ELEC KW	136	136-4.7	1180	180-40	7 180	180
GENERATUR. (KW)	422	422	40.00 S	4 42	422	422
NET KW	286	286	242	242	1 74 x 30x 0	242
NET KWW	212,784	192,192	180,048		180,04.2	174,240
	16,216B	TU × 422	KW X 1031		1	
ì			D04.7			

JOB WSMR ESUS STUDY # 1110-000

CALCULATED BY TF DATE 11-09-9

CHECKED BY ______ DATE _____

SCALE _

E M C ENGINEERS, INC.

Denver • Atlanta • Germany

	JUL	Au6	SEP	OCT	NOV	DEC
#2712/m 2.	744	744	720	744	720	744
LUAD (TONS)	347.8	323.8	226,3	120,8	49.2	29.3
CHILLER PART LOAD	.87	. 81	.57	.33	-12	.07
(LB/HR-TUN)	11,44	11.44	11.44	11.44	11.44	11.44
(HILLER ETEAM FLOW (LB/HR)	3,978.8	3,704,3	2,588.9	1,382	562.8	335.2
HRS 6 STEAM PRODUCTION (LB/HR)	3,978.8	3,704.3	2,588,9	1,382	562.7	335.2
BOILER STEAM PROMICTION (LBY HR)	0	٥	٥	j	ပ	.
ESILER FUEL (MB+u/no)	0	Ø	o	0	0	0
(sasturbino fuel (MBtu/mo)	55488	5,548.8	5,344.8	5,548.8	5,369.8	5,548.8
PLANT ELEC KW	180	180	180	180	136	136
GENERATUR.	422	422	4-22	4-2-2	422	422
NGT KW (KM)	242	242	242	242	286	286
NET KWY	180,048	180,048	174,240	180,048	205,920	212,784

D24-8